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Where is the Information on USD/Bitcoin Hourly Prices?

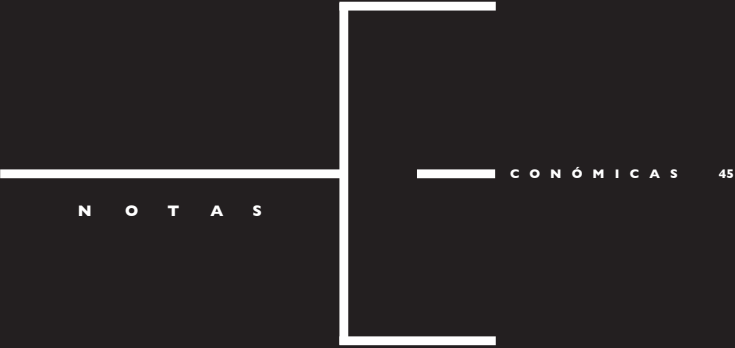
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José Reis (Faculdade de Economia, U. Coimbra; jreis@fe.uc.pt)
Miguel Sousa (Faculdade de Economia, U. Porto; msousa@fep.up.pt)

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Helder Sebastião
Faculdade de Economia
Universidade de Coimbra
helderse@fe.uc.pt
António Portugal Duarte
Faculdade de Economia
Universidade de Coimbra
portugal@fe.uc.pt
Gabriel Guerreiro

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WHERE IS THE INFORMATION ON USD/BITCOIN HOURLY PRICES?

Helder Sebastião
António Portugal Duarte
Gabriel Guerreiro

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ABSTRACT

This paper analyses the price discovery in the USD/Bitcoin market since Mar-2014 to Nov-2016. The results show a positive relationship between the informational relevance of exchanges and their market shares. Information is mostly transmitted between exchanges within an hour, at least for the main exchanges, although lagged feedbacks occur from the major exchanges. Minor exchanges are merely satellite ones and react to price information with some delay. Bitfinex is the most important exchange: the lagged feedback from this exchange to the market is 18.3%, while the reverse feedback accounts only for 0.6% of the total feedback. Volatility in the major exchanges is the main factor explaining the feedback measures, which sustains the claim that the relative importance of the information-based component of volatility increases with the relative dimension of the exchange.

Keywords: Bitcoin; price discovery; high frequency; Geweke feedback measures; volume; volatility.

JEL Classification: F13; G12; G14; G15.

1. INTRODUCTION

Bitcoin is a decentralised open source peer-to-peer (P2P) crypto-currency protocol, firstly presented in a self-published paper by the mysterious Satoshi Nakamoto on 31-Oct-2008. Nakamoto (2008) describes a mathematical system that can be used to produce and manage a virtual currency, mainly designed for supporting online transactions. Its main merit, which is the basis for its success in relation to other virtual currencies, is to solve the double spending problem (when an individual, conducting an online transaction, sends the same money to two counterparts at the same time) without the need for a third trusted intermediary. Moreover, while other online payment systems, such as PayPal and eBay, still have impediments in cross-border transactions, Bitcoin allows its holders to trade across borders, in an increasingly global marketplace (ECB, 2012; Lancelot and Tatar, 2013; Pagliery, 2014; Pieters, 2016).

As a crypto-currency, Bitcoin is digital, without physical existence nor country of origin. Bitcoin is issued and controlled by its users and is accepted among the members of an increasing virtual community, therefore is not subjected to any regulation or supervision from a monetary authority. Bitcoins are created by solving a complex mathematical algorithm in a process known as “mining”, which is transparent, decentralised, and overseen by the Bitcoin protocol users. The winning miner is awarded a given amount of new Bitcoins, while the losers get nothing. Hence, this activity is characterized as a “competitive bookkeeping” by Harvey (2016). Bitcoins are sent and received via Bitcoin addresses. However, because there is no central processing authority, transactions between users must be confirmed by consensus: a private Bitcoin key of one user has to match the public Bitcoin key of another user. This is made possible through the Bitcoin’s “blockchain”, which is essentially a public chronological log of every confirmed Bitcoin transaction (ECB, 2012). The Bitcoin supply has increased at a predictable rate, depending on the number of “miners” and traders, technological advances and energy costs.

Bitcoin tends to be subjected to a deflationary process as the demand becomes higher than the supply (Nakamoto, 2008; Fink and Johann, 2014). The historical appreciation of Bitcoin has been impressive. Some anecdotal evidence can grasp this: the first product bought using Bitcoins was two pizzas on 21-May-2010, for a price of 10000 BTC, roughly 25 USD at that time (Fink and Johann, 2014). At the time of writing, the price for one Bitcoin is around 1188.46 USD; so, at the actual prices, this is probably the most expensive meal in the history of mankind! The exponential appreciation of Bitcoin seems to be behind the increasing interest that Bitcoin is gaining in the online trading community.

Since its online creation in 2009, Bitcoin has grown from a new digital currency traded essentially between enthusiasts, to a booming payment system receiving substantial media attention for its conceptual merits. The market capitalisation of Bitcoin surpassed 25 billion USD recently, and the transaction volume keeps growing in a more global and diversified scale. By now, approximately 16.9 million Bitcoins are in circulation (the absolute maximum is 21 million BTC) and there are more than fifty Bitcoin exchanges offering trades against different currencies, with USD and CNY being the most important ones (data on 3-May-2017).

In 2010, the first currency exchanges emerged, with Mt.Gox claiming the market leadership, holding a market share of more than 80% during the next two years (Brandvold et al., 2015). Later, exchange-trading volumes at Bitstamp, BTC-e and Bitfinex rose as Mt.Gox's fell down, due to several technical incidents and legal issues. In the second half of 2013, those three exchanges took more than 50% of USD/BTC market share and, in Feb-2014, Mt.Gox suspended all transactions after a serious security breach.

In terms of economic literature, the study of the Bitcoins phenomenon is still relatively limited, namely in respect to the price discovery process on the currency exchanges. This paper addresses this issue by examining transaction data on fourteen Bitcoin exchanges that were active at least one year since the Mt.Gox bankruptcy (1-Mar-2014) until the aftermath of the hack attack on Bitfinex (30-Nov-2016).

The remainder of the paper is organised as follows. Section 2 presents a brief literature review. Section 3 refers to the data and presents a preliminary analysis. Section 4 describes the methodology, namely the Geweke feedback measures and the procedure for the panel regression analysis. The results of the empirical application are shown in Section 5. The paper concludes in Section 6.

2. LITERATURE REVIEW

Most papers and books on Bitcoin are from the fields of computer sciences and cryptography, therefore focusing essentially on the explanation of technical and methodological features of the Bitcoin network, mining activity and blockchain knowledge.¹

Barber et al. (2012), Bradbury (2013), Eyal and Sirer (2014) and Böhme et al. (2015) discuss technical aspects of the Bitcoin project, trying to understand the reasons behind its success. Tu and Meredith (2015) and Karame et al. (2015) analyse security and legal issues in crypto-currency systems. Reid and Harrigan (2013) and Ron and Shamir (2013) dedicate more attention to the analytical aspects related to the information contained in the blockchain. The latter authors show, in particular, that a large fraction of issued Bitcoins is “dormant”, in the sense that they were issued and never traded again.

An issue that has also attracted some attention in the academic world is the discussion on if Bitcoin is in fact a currency. Naturally, central banks have been quite concerned with this issue, for instance the ECB (2012) argues that, like any currency, Bitcoin depends on trust, which is not supported by its intrinsic value or on the belief in a central monetary authority solvency, but rather on cryptography and computer technology. Although several concepts of money have been associated to the Bitcoin phenomenon, such as “crypto-currency” (Elias, 2011; Evans, 2014; Böhme et al., 2015), “digital currency” (Grinberg, 2011; Dwyer, 2015) or “virtual currency” (ECB, 2012; Tu and Meredith, 2015), for some authors Bitcoin cannot be considered a currency. Yermack (2013), for instance, argues that the Bitcoin exhibits excess volatility, has no correlation with classical currencies and is not regulated. Brière et al. (2015) also argue that Bitcoins seem to be a valuable asset for portfolio diversification

¹ Velde (2013) presents a comprehensive overview of the Bitcoin project. A literature review on Bitcoin can be found in Li and Wang (2017).

and Fink and Johann (2014) defend that, in its current usage, Bitcoin is more an investment vehicle than a currency.

A set of few studies have also investigated the Bitcoin exchange market. Some of these studies focus their attention on the existence of speculative bubbles (Cheung et al., 2015; Cheah and Fry, 2015) and Glaser et al. (2014) have even questioned the motivations behind the implementation of Bitcoin and the resemblance of its exchange activities to pure speculative trading.

More recently, the economic literature on Bitcoin was directed predominantly towards the conduction of econometric analyses regarding the identification and explanation of the main determinants of the Bitcoin exchange rate. Kristoufek (2013) shows a very high correlation between the Google Trends, Wikipedia views on Bitcoins and the Bitcoin exchange rate, and, in a later paper, Kristoufek (2015) shows that speculative behaviour and the exchange-trade ratio play a significant role at lower frequencies. Bouoiyour and Selmi (2015) also identify several determinants of the Bitcoin exchange rate, including Google searches, hash rate, ratio of exchange-trade volume and stock market dynamics, while Polasik et al. (2015) conclude that Bitcoin returns are mainly driven by news volume, news sentiment and the number of traded Bitcoins.

In what concerns to price discovery process in Bitcoin currency exchanges, to the best of our knowledge, the existing literature is quite scarce. Fink and Johann (2014) study several aspects of the Bitcoin exchange market, showing that Bitcoin prices experience extreme returns and high volatility and that the market is not informationally efficient, while the largest Bitcoin exchanges are cointegrated. According to the authors, transaction frequency, ownership, and size are broadly dispersed across more than fifteen million Bitcoin users, which shows that the Bitcoin is traded by both retail and professional traders with different strategies. The price discovery leader was the Mt.Gox exchange before its bankruptcy, but after that event the market shares and price discovery across Bitcoin exchanges are more balanced. Brandvold et al. (2015) conclude that for the whole sample period (1-Apr-2013 to 25-Feb-2014) Mt.Gox, together with the BTC-e, were the market leaders, while the rest of the exchanges were less informative, but still providing some information to the Bitcoin exchange market. They also determine that information shares are dynamic and evolving significantly over time. While Mt.Gox dominated the price discovery process, its information share decreased significantly but still was higher than its activity share. BTC-e was one of the most informative exchanges and was much more informative than other exchanges during the shutdown of the Silk Road.

3. DATA AND PRELIMINARY ANALYSIS

The data for this study was mainly collected from the site www.bitcoincharts.com. This aggregation site compiles transaction data on several exchanges that trade Bitcoins against different currencies, being the USD and CNY the most important ones. Although Bitcoin high frequency data is available for free in other public sites, it seems that this database is quite reliable and has already been used in several academic papers (for instance, in Fink and Johann, 2014; Brandvold et al., 2015; Pieters, 2016).

In this paper, we just focus on the USD/BTC market. The main reason for this, relies on the fact that there has been some rumours that the main exchanges dealing with the Chinese Yuan, which of course, have their headquarters in China, tend to exaggerate their trading volume in order to attract more traders.²

The sample period was defined by two particular events. On 25-Feb-2014, Mt.Gox closed permanently for business. Before its bankruptcy, Mt.Gox was by far the dominant exchange in the USD/BTC market with a share of 74.83% of trading volume (from Jan-2010 to Feb-2014). Even at the closing day, the daily market share of Mt.Gox (33.46%) was still above the market share of any of its rivals (Bitstamp 28.01%, Bitfinex 20.60%, and BTC-e 17.12%). On the early afternoon of 2-Aug-2016, Bitfinex halted trading after discovering that roughly 120 thousand BTCs were stolen. Bitfinex stayed closed for seven days, until 8-Aug-2016. On 8-Dec-2017, the site bitcoincharts ended publishing Bitfinex data, due to a change in their API.³ Given these events and the data available, we selected a sample period of 1006 days, since 1-Mar-2014 until 30-Nov-2016.

We also had to decide on the sampling frequency. There is a trade-off between gathering as much information as one can and avoiding the effects of microstructural noise and non-synchronous trading. For instance, Fink and Johann (2014) use a 1-minute interval while Brandvold et al. (2015) use a 5-minutes interval. Here, because we intend to study also low trading frequency exchanges, we choose a sampling interval of one hour. At this frequency, we collect information on hourly price indexes weighted by trading volume and trading volume in BTC. The use of price indexes instead of transaction prices (e.g. last price before the sampling point) smooths the price time series and diminishes the impact of extreme trades documented in Brandvold et al. (2015). On the other hand, it allows us to take into account that Bitcoin may be traded at small quantities. One Bitcoin can be divided down to one satoshi, i.e. 10^{-8} of a unit, and trades with volumes lower than 0.1 BTC are the most common ones (Brandvold et al., 2015).

Finally, we had to decide what exchanges we would use in this study from the 52 exchanges that trade USD/BTC and have data available at the bitcoincharts site. The criterion was to consider those exchanges that were active at least one year during the sample period (1-Mar-2014 to 30-Nov-2016). We end up with 14 exchanges, which account for 74.34% of the total Bitcoins traded against USD during the sample period (72.71 million BTC in all exchanges). Table 1 presents some information on these exchanges with a focus on its trading activity.

² For instance, the total traded volume of BTC against CNY, since 15-Mar-2015 until 14-Mar-2017, according to the site data.bitcoinity.org, was approximately 1.3 billion, which roughly means a market share of 94% during that period, while the USD market share was only 4.06%. About this issue see, for instance, the news article “Chinese Bitcoin Exchange OKCoin Accused of Faking Trading Data”, written by Eric Mu on 21-Dec-2013 (available at <http://www.coindesk.com>).

³ API means Application Programming Interface and it is a set of commands, protocols, functions and objects aimed to create software or to interact with an external system.

Table 1: Exchange information

Exchanges	Headquarters	Data availability	Volume	Average time lag	Volume per trade
Bitfinex	Hong Kong	Full sample	22.148 (30.46%)	10s	2.548
Bitstamp	Luxembourg	Full sample	11.099 (15.27%)	12s	1.532
BTC-e	Bulgaria	Full sample	7.3712 (10.14%)	5s	0.424
Coinbase	San Francisco USA	Since 1-Dec-2014	5.0439 (6.94%)	7s	0.406
ItBit	New York USA	Full sample	3.6011 (4.95%)	1m59s	4.930
LakeBTC	Shanghai China	Until 19-Jun-2015	2.1103 (2.90%)	24s	0.583
LocalBitcoins	Finland	Since 11-Mar-2013	1.6223 (2.23%)	52s	0.971
Kraken	San Francisco USA	Full sample	0.4260 (0.59%)	3m11s	0.936
HitBTC	UK	Full sample	0.3526 (0.48%)	1m36s	0.389
Onecoin	Bulgaria	9-Mar-2014 to 4-Apr-2015	0.2318 (0.31%)	1m54s	0.029
Rock	Malta	Full sample	0.0206 (0.03%)	23m34s	0.335
CampBX	Atlanta USA	Until 19-Oct-2016	0.0150 (0.02%)	36m49s	0.267
BitKonan	Croatia	Full sample	0.0096 (0.01%)	58m6s	0.385
Bitbay	Poland	Since 16-May-2014	0.0091 (0.01%)	19m12s	0.121

Notes: This table shows some information on the 14 exchanges used in this study, namely: Headquarters, period of data availability at www.bitcoincharts.com, total trading volume USD/BTC in millions of BTC (where the values in parenthesis present the volume of each exchange relative to the total trading volume of the overall USD/BTC market – 72.71 million BTC according to <https://data.bitcoinity.org>), average time-lag between consecutive trades in minutes and seconds and average volume per trade during the sampling period (1-Mar-2014 to 30-Nov-2016).

Bitfinex, Bitstamp and BTC-e stand out as the three main exchanges with a total volume of roughly 56% of the USD/BTC market, in a second level are Coinbase and ItBit with roughly 12% of the total volume. In order to analyse the price discovery process among all exchanges we need a continuous time series without many gaps, hence we decide to isolate Bitfinex, Bitstamp, BTC-e and ItBit from all the other 10 exchanges, compiled into a pool of exchanges, which we denominate by “Others”. The exchange Coinbase is included into this basket not because its trading volume is low but due to its late opening on the 01-Dec-2014, nine months after the sample beginning. The trading volume for

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Others is simply obtained by adding up the trading volume of these 10 exchanges, while the price is computed as an average of the prices in these exchanges, using the trading volume as a weighting scheme.

From now on, we will assume that the USD/BTC market was totally composed, since 1-Mar-2014 until 30-Nov-2016, by Bitfinex with a market share, given by the relative trading volume, of 40.97%, Bitstamp, 20.53%, BTC-e, 13.64%, ItBit, 6.66% and Others, 18.20%. In this last case, it means an average market share per exchange of 1.82%. Table 2 shows the preliminary statistics of the hourly logarithmic returns for the exchanges under scrutiny.

Table 2: Descriptive statistics on returns

	Bitfinex	Bitstamp	BTC-e	ItBit	Others
No. of zeros	203 (0.8%)	108 (0.4%)	653 (2.7%)	3580 (14.8%)	0
Mean (10^{-5})	1.2531	1.3131	1.3203	1.1261	1.0927
Minimum	-0.1656	-0.1390	-0.1498	-0.5056	-0.4771
Percentile 5	-0.0086	-0.0087	-0.0080	-0.0082	-0.0257
Median	0.0000	0.0001	0.0000	0.0000	0.0003
Percentile 95	0.0085	0.0083	0.0080	0.0079	0.0248
Maximum	0.1053	0.1178	0.1016	0.5428	0.4967
Stand. deviation	0.0063	0.0062	0.0062	0.0081	0.0179
Skewness	-1.0749	-0.6081	-0.9125	2.1412	-0.0693
Kurtosis	43.590	34.074	48.419	151.76	68.504
Jarque-Bera (10^6)	1.6620 ***	0.9728 ***	2.0786 ***	2307.6 ***	4.3163 ***
Autocorr(1)	0.1282 ***	0.1416 ***	0.1139 ***	0.0089	-0.3578 ***
Autocorr(2)	-0.0879 ***	-0.0772 ***	-0.0589 ***	-0.2176 ***	-0.0187 ***
Autocorr(3)	-0.0466 ***	-0.0488 ***	-0.0365 ***	-0.0154 **	0.0092
BIC	3	3	3	5	52

Notes: This table summarises the statistics for the hourly logarithmic returns of the USD/BTC exchange rates. The sample covers the period since 1-Mar-2014 until 30-Nov-2016, for a total of 1006 days (24143 hourly observations). The exchanges are Bitfinex, Bitstamp, BTC-e, ItBit and "Others". This last one refers to a compilation of several minor exchanges (Coinbase, LakeBTC, LocalBitcoins, Kraken, HitBTC, Onecoin, Rock, CampBx, BitKonan and Bitbay). The Others' price upon which the returns are computed is the price index averaged by volume. BIC denotes the Bayesian-Information Criterion for choosing the lag length in an autoregressive process. The autocorrelations significance levels were inferred using Bartlett's standard errors. Values significant at the 10%, 5% and 1% levels are marked by *, ** and ***, respectively.

The number of staled prices seems only to be a problem for ItBit, where 14.8% of the returns is zero. The mean and median returns are almost zero, but the returns show positive and negative extreme values. This is particularly true for ItBit, with a minimum and a maximum hourly returns of -50.56% and 54.28%, and for the basket Others with a minimum of -47.71% and a maximum of 49.67%. The standard deviation is inversely related with the exchange's dimension; for instance, the standard deviation of Others is more than twice the standard deviation of the four bigger exchanges. The returns are obviously non-normal, presenting negative skewness (except for the ItBit) and leptokurtosis. ItBit also shows a higher kurtosis than the other exchanges. The first order autocorrelations are significantly positive, except for Others that is negative. The second and third order autocorrelations are all significantly negative (except the third order autocorrelation for Others). Although persistence should be inversely related to the trading intensity and should be higher in Others as a result of the averaging procedure, it revealed to be quite higher than expected. The Bayesian-Information Criterion indicates that modelling the returns of Others by an autoregressive process would imply using a lag length of 52, which means using self-information for more than two days.

Before proceeding with the estimation of the feedback measures, we verified if all return series were stationary by applying ADF tests, without constant and trend, and with a lag length inferred by the BIC. For all the returns series the tests were categorical in rejecting the null hypotheses of a unit root at a 1% significance level.

4. METHODOLOGY

In order to assess the informational relationship between exchanges we use the feedback measures of Geweke (1982). These measures are applied pairwise for each pair of exchanges and between each exchange and the rest of the market, formed by all the other exchanges. We also proceed with a second stage analysis by conducting panel regressions of the feedback measures on market variables, such as volatility and volume.

The analysis is conducted on a bivariate return process, such that r_{it} and r_{jt} are the returns in market i and j at time t , respectively, computed from the volume weighted prices. Consider that a pair of Bitcoin time series of returns, $\{r_{it}, r_{jt}\}$, sampled at some frequency, say hourly, can be expressed as a bivariate autoregressive process of an arbitrary order p :

$$\begin{bmatrix} r_{it} \\ r_{jt} \end{bmatrix} = \begin{bmatrix} A(L) & B(L) \\ C(L) & D(L) \end{bmatrix} \begin{bmatrix} r_{it} \\ r_{jt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{it} \\ \varepsilon_{jt} \end{bmatrix}, \quad (1)$$

where $A(L)$, $B(L)$, $C(L)$ and $D(L)$ are polynomials in the lag operator, L , and the innovations are Gaussian (i.e. ε_{kt} are independently and identically $\mathcal{N}(0, \sigma_k^2)$, for $k = i, j$). The innovations covariance matrix is

$$\mathbf{\Omega} = cov \begin{bmatrix} \varepsilon_{it} \\ \varepsilon_{jt} \end{bmatrix} = \begin{bmatrix} \sigma_i^2 & \sigma_{ij} \\ \sigma_{ji} & \sigma_j^2 \end{bmatrix}. \quad (2)$$

Absence of Granger causality, denoted by “ \rightrightarrows ” implies that the coefficient matrix is triangular in the VAR representation. For a bivariate process, there are two lagged feedback hypotheses: $H_{i \rightrightarrows j}: C(L) = \mathbf{0}$ and $H_{j \rightrightarrows i}: B(L) = \mathbf{0}$. Under these hypotheses, the VAR simplifies to:

$$\begin{bmatrix} r_{it} \\ r_{jt} \end{bmatrix} = \begin{bmatrix} A(L) & \mathbf{0} \\ \mathbf{0} & D(L) \end{bmatrix} \begin{bmatrix} r_{it} \\ r_{jt} \end{bmatrix} + \begin{bmatrix} \xi_{it} \\ \xi_{jt} \end{bmatrix}. \quad (3)$$

Additionally, if there is no contemporaneous linear relationship between the series, $H_{i \leftrightarrow j}$, then $cov(\xi_{it}, \xi_{jt}) = 0$. The hypothesis of no linear link between the two variables is given by the conjunction of the previous hypotheses: $H_{i \cdot j} = H_{i \rightrightarrows j} \cap H_{i \leftrightarrow j} \cap H_{j \rightrightarrows i}$. The measures proposed by Geweke (1982) allow testing these hypotheses:

Measure of lagged feedback from i to j :

$$F_{i \rightarrow j} = \ln(\sigma_{\xi_j}^2 / \sigma_{\varepsilon_j}^2). \quad (4)$$

Measure of lagged feedback from j to i :

$$F_{j \rightarrow i} = \ln(\sigma_{\xi_i}^2 / \sigma_{\varepsilon_i}^2). \quad (5)$$

Measure of contemporaneous feedback between i and j :

$$F_{i \leftrightarrow j} = \ln(\sigma_{\varepsilon_i}^2 \sigma_{\varepsilon_j}^2 / |\mathbf{\Omega}|). \quad (6)$$

Measure of total feedback between i and j :

$$F_{i,j} = \ln(\sigma_{\xi_i}^2 \sigma_{\xi_j}^2 / |\mathbf{\Omega}|). \quad (7)$$

Where $|\mathbf{\Omega}|$ denotes the determinant of the innovations covariance matrix in the unrestricted model. Under the null hypothesis, these measures, multiplied by the number of observations, T , are asymptotically independent and follow chi-squared distributions with p , p , 1 and $2p+1$ degrees of freedom, respectively.

The feedback measures are just the log-likelihood ratio statistics for the null hypotheses, and, therefore, if feedback is present, their asymptotic distributions are well defined. Under

the alternative hypothesis, these measures, multiplied by the number of observations, are asymptotically non-central chi-squared:

$$TF_{i \rightarrow j}^{\hat{A}} \sim \chi^2(p, TF_{i \rightarrow j}), \quad (8)$$

$$TF_{j \rightarrow i}^{\hat{A}} \sim \chi^2(p, TF_{j \rightarrow i}), \quad (9)$$

$$TF_{i \leftrightarrow j}^{\hat{A}} \sim \chi^2(1, TF_{i \rightarrow j}), \text{ and} \quad (10)$$

$$TF_{i,j}^{\hat{A}} \sim \chi^2(2p+1, TF_{i,j}), \quad (11)$$

The Geweke feedback measures have several advantages over other methodologies, such as the Wald F-test: (i) under the alternative hypothesis these statistics represent cardinal measures of the extent of linear dependence in the two series, (ii) these measures are additive: $\hat{F}_{i,j} = \hat{F}_{i \rightarrow j} + \hat{F}_{i \leftrightarrow j} + \hat{F}_{j \rightarrow i}$, (iii) comparison between the feedback in two pair of variables is straightforward as long as the measures are estimated using the same number of observations, and (iv) these metrics are unaffected by prefiltering the series by any invertible lag operator (Parzen, 1982), which suggests that they are less sensitive to the effects of non-synchronous trading and other microstructural idiosyncratic sources of noise.

In the second stage of our analysis, we compute a time series of the feedback measures for each different pair of exchanges using a non-overlapping rolling window with the same length. This rolling window procedure is also used to compute the time series of the trading intensity, measured by the log-volume in Bitcoins, vol , and of the volatility for each exchange. Although volume and volatility are usually highly correlated, they may account for different types of information arrival processes (Andersen, 1996). For measuring volatility, we use the range estimator of Parkinson (1980):

$$HL = \left[(1/D) \sum_{d=1}^D \frac{(\ln(H_d/L_d))^2}{4 \ln(2)} \right]^{\frac{1}{2}}. \quad (12)$$

Where D is the number of days in the window, and H_d and L_d are the maximum and minimum prices (weighted by volume) recorded on day d . Although the Parkinson estimator assumes no drift and it tends to underestimate volatility, it seems a good candidate to measure volatility in a continuous trading market (other more efficient range volatility estimators, such as Garman and Klass, 1980; Rogers and Satchell, 1991; Yang and Zhang, 2000, also consider the opening and closing prices). Moreover, one should notice that the bias present in the Parkinson estimator is not an important issue here since we are using the estimator for comparing the volatility between markets, in just a few days, instead of using it to compare volatilities through time.

The regression analysis was conducted as follows. Firstly, the feedback measures were normalized using the procedure prescribed by Geweke (1982). If $TF^{\hat{A}} \sim \chi^2(df, TF)$, where df is the degree of freedom and TF is the non-centrality parameter, then

$$n\hat{F} = (|TF^{\hat{A}} - (df - 1)/3|)^{\frac{1}{2}} \sim \mathcal{N}((|TF^{\hat{A}} - (df - 1)/3|)^{\frac{1}{2}}, 1). \quad (13)$$

Secondly for each pair of markets, i and j , and for each normalized measure, $n\hat{F}_{i \rightarrow j}$, $n\hat{F}_{j \rightarrow i}$, $n\hat{F}_{i \rightarrow j}$ and $n\hat{F}_{i,j}$, we construct a matrix of regressors, $[HL_i, HL_j, vol_i, vol_j]$. With the purpose of simplifying the interpretation of the results, the pair (i, j) is constructed considering in the first entry the exchange with the highest market share (given by the trading volume). So, for \mathcal{N} exchanges we have $\mathcal{N}(\mathcal{N} - 1)/2$ time series on each feedback measure. Finally, for each feedback measure we run the following panel regression:

$$n\hat{F}_{(i,j)t} = \beta_0 + \beta_1 HL_{it} + \beta_2 HL_{jt} + \beta_3 vol_{it} + \beta_4 vol_{jt} + \vartheta_{(i,j)t} \quad (14)$$

The regression analysis on the feedback measures has been used elsewhere. For instance, Kawaller et al. (1993) use this methodology to study the interrelationship between stock index and stock index futures, Bracker et al. (1999) study the evolution of integration, measured by contemporaneous feedback, between several national stock markets. In this last paper, the authors use a pooled regression and combine the two lagged feedback measures, arguing that they are analogous in economic and statistical terms.

Our perspective is different. Firstly we do not superimpose the data pooling and instead let the data tell us what is the best model (pooled regression, panel with fixed effects or panel with random effects). Secondly, we do not aggregate the lagged feedback measures and instead we model them separately. Obviously the two measures are statistically similar but they may be economically different, the impact of volatility and volume from a particular exchange on a feedback measure may be different depending on if it is a leader or a follower exchange.

The methodological design allows us to formulate several hypotheses. Basically, most of these hypotheses are drawn upon the Wall Street adage “It takes volume to make prices move”. On other hand, we also assume that volatility is mostly information-driven, especially if it is from the leader exchange and therefore volatility should increase the exchanges’ proximity.

From the pairwise estimations of the feedback measures we can test the following hypothesis:

H1: The ranking of the pairs of exchanges by the total feedback is the same as its ranking by the combined volume of the two exchanges.

H2: At an hourly sampling, the great contributor for the total feedback is the contemporaneous feedback, and its contribution increases with the combined volume of the two exchanges.

H3: In each pair, the lagged feedback runs mostly from the exchange with higher volume to the other exchange, and the difference between the lagged feedbacks is positively related to the difference in trading volumes.

In the same line of reasoning, we can also formulate hypotheses on the expect signs of the regressors in Eq. (14).

H4: All the variables in the contemporaneous feedback regression have positive signs.

H5: All the variables in the total feedback regression have positive signs.

H6: In the lagged feedback regressions, $i \rightarrow j$, volume and volatility of exchange i have positive signs, while volume and volatility of exchange j have negative signs.

In the next section we present the empirical results that allow us to infer about the validity of these hypotheses.

5. RESULTS

Firstly, we estimate the feedback measures pairwise, considering the exchanges Bitfinex, Bitstamp, BTC-e, ItBit and Others, where this last one is a pool of minor exchanges (Coinbase, LakeBTC, LocalBitcoins, Kraken, HitBTC, Onecoin, Rock, CampBx, BitKonan and Bitbay). The estimates were obtained from fitting VARs with a lag structure truncated at lag 52, which is the longest lag structure inferred by the Bayesian-Information Criterion applied to the univariate time series of hourly continuous returns. Using such lag length enable us to capture all the autocorrelation and lagged cross-correlation structure, even in the Others returns. Results are presented in Table 3.

Table 3: Pairwise estimation of feedback measures

Exch. (<i>i</i>)	Exch. (<i>j</i>)	Average Share	$F_{i \rightarrow j}$	$F_{j \leftarrow i}$	$F_{j \rightarrow i}$	F_{ji}
Bitfinex	Bitstamp	30.75%	0.0495 (3.41%)	1.3948 (96.11%)	0.0070 (0.47%)	1.4512
Bitfinex	BTC-e	27.31%	0.059 (6.24%)	0.8783 (92.82%)	0.0089 (0.94%)	0.9463
Bitfinex	ItBit	23.82%	0.1361 (23.13%)	0.4485 (76.21%)	0.0039 (0.67%)	0.5886
Bitstamp	BTC-e	17.09%	0.0412 (4.35%)	0.8838 (93.33%)	0.0220 (2.32%)	0.9469
Bitstamp	ItBit	13.60%	0.1211 (19.81%)	0.4830 (79.02%)	0.0071 (1.17%)	0.6112
BTC-e	ItBit	10.15%	0.0888 (19.90%)	0.3447 (77.24%)	0.0128 (2.87%)	0.4463
Bitfinex	Others	5.38%	0.1615 (64.70%)	0.0864 (34.61%)	0.0017 ^(a) (0.69%)	0.2497
Bitstamp	Others	3.52%	0.1653 (62.51%)	0.0974 (36.82%)	0.0018 ^(a) (0.67%)	0.2645
BTC-e	Others	2.89%	0.1300 (60.49%)	0.0811 (37.74%)	0.0038 (1.77%)	0.2149
ItBit	Others	2.26%	0.1033 (52.78%)	0.0758 (38.70%)	0.0167 (8.52%)	0.1958

Notes: Geweke's feedback measures were estimated for all pairs of exchanges using hourly logarithmic returns. The column "Average Share" gives the total market share of the exchanges divided by the number of exchanges (2 for all pairs, except for the pairs that include Others, where the divisor is 11). The "Average Share" is used to order the pairs in the table. Others refers to a compilation of several minor exchanges (Coinbase, LakeBTC, LocalBitcoins, Kraken, HitBTC, Onecoin, Rock, CampBx, BitKonan and Bitbay). The feedback measures were obtained from fitted VAR models with a lag structure truncated at 52. The lagged feedback from *i* to *j* and from *j* to *i* are denoted by $F_{i \rightarrow j}$ and $F_{j \rightarrow i}$ respectively, while the simultaneous feedback is denoted by $F_{j \leftarrow i}$ and the total feedback is $F_{j \cdot}$. The relative weight (i.e. divided by the total feedback) of the lagged feedbacks and simultaneous feedback are shown in parentheses. All the estimates are significant at the 1% level, except the lagged feedback from Others to Bitfinex and to Bitstamp that are not significant at the 10% level. These two estimates are marked by ^(a).

As expected, the total feedback is highly correlated with the average market share, implying that the interrelationship between exchanges increases with their relative volume. However, the ordering is not exactly the same and the total feedbacks between Bitstamp and BTC-e and between Bitstamp and ItBit are higher than the total feedback between Bitfinex and ItBit, despite this last pair sharing a higher trading volume. This probably means that market proximity, in terms of trading volume, also tightens prices together.

The contemporaneous feedback is the main contributor to the total feedback, except when Others is included in the pair. In this case, the contemporaneous feedback only accounts for about to 34% to 39% of the total feedback, and most of the feedback runs from the major exchange to Others (52.78% to 64.70%). The contemporaneous feedback ranges from 96.11% of the total feedback in the Bitfinex/Bitstamp pair and only 34.61% of the total feedback in the Bitfinex/Others pair. The lagged feedback is asymmetrical and runs dominantly from the major exchange than the other way around. These figures range from 0.0495 (3.41% of total feedback) in the Bitfinex/Bitstamp pair to 0.1615 (64.70%) in the Bitfinex/Others pair. The feedback from the minor exchanges is quite marginal, with a maximum absolute value of 0.022 in the Bitstamp/BTC-e pair and a maximum relative value of 8.52% in the ItBit/Others pair. In fact, the only estimates that are not significant (even at the 10% level) are the lagged feedback from Others to the two major exchanges, Bitfinex and Bitstamp.

Overall, Table 3 indicates that the three major markets are highly integrated. In these markets, the relative contemporaneous feedback estimates suggest that more than 92% of price variability is communicated between markets within one hour. The level of integration decays with ItBit, which has a relative contemporaneous feedback of around 77% with the three major markets. The basket Others mostly reacts to price changes with a delay of at least one hour and therefore the minor exchanges compiled into Others may be seen as pure satellite exchanges, in the sense of Garbade and Silber (1979). However, we have to keep in mind that this last result is in part due to smoothing the price series across ten minor exchanges.

Although the results suggest that Bitfinex is the dominant market in terms of the transmission of short run price information, we now try to answer directly to this question. In order to position each exchange in the overall USD/BTC market we computed the feedback measures between each exchange and the Market, where its return is computed upon the price index averaged by volume of the remaining exchanges. Table 4 presents these results, where in Panel A the Market includes the basket Others and Panel B considers the Market formed only by the most important four exchanges.

Table 4: Feedback measures between each exchange and the market

Exchange (i)	$F_{i \rightarrow M}$	$F_{j \leftarrow M}$	$F_{M \rightarrow i}$	$F_{i,M}$
Panel A: Including Others				
Bitfinex	0.2031 (38.55%)	0.3219 (61.08%)	0.0020 ^(a) (0.40%)	0.5270
Bitstamp	0.1666 (25.53%)	0.4779 (73.21%)	0.0082 (1.26%)	0.6527
BTC-e	0.1122 (22.18%)	0.3786 (74.83%)	0.0151 (2.99%)	0.5060
ItBit	0.0565 (22.18%)	0.2953	0.0737	0.4256
Others	0.0048 (1.95%)	0.0849 (34.73%)	0.1549 (63.32%)	0.24454
Panel B: Excluding Others				
Bitfinex	0.1702 (18.29%)	0.7542 (81.06%)	0.0060 (0.65%)	0.9304
Bitstamp	0.1020 (10.10%)	0.8824 (87.37%)	0.0255 (2.53%)	1.0099
BTC-e	0.0401 (4.72%)	0.7701 (90.50%)	0.0407 (4.79%)	0.8510
ItBit	0.0086 (1.47%)	0.4465 (76.31%)	0.1300 (22.21%)	0.5852

Notes: Geweke's feedback measures were estimated for all pairs exchange/Market, using hourly logarithmic returns. For the Market, denoted by M , the returns are computed upon the price index, weighted by volume, of all remaining exchanges. Panel A includes in the Market the minor exchanges compiled into the basket Others, while Panel B only considers Bitfinex, Bitstamp, BTC-e and ItBit. The feedback measures were estimated from fitted VAR models with a lag structure truncated at 52. The lagged feedback from i to M and from M to i are denoted by $F_{i \rightarrow M}$ and $F_{M \rightarrow i}$ respectively, while the simultaneous feedback is denoted by $F_{i \leftarrow M}$ and the total feedback is $F_{i,M}$. The relative weight (i.e. divided by the total feedback) of the lagged feedbacks and simultaneous feedback are presented in parentheses. All the estimates are significant at the 1% level, except the lagged feedback from the Market to Bitfinex that is not significant at the 10% level. This estimate is marked by ^(a).

Not surprisingly, we notice that when we exclude Others from the analysis, all the lagged feedback measures from an exchange to the Market decrease, while all the lagged feedback measures from the Market to an exchange increase. The degree of integration (contemporaneous feedback) is quite higher when minor exchanges are excluded, which also roughly doubles the total feedback. One can observe from Panel A that the contemporaneous feedback is the major contributor to the total feedback, with this measure presenting a relative weight above 61%, except in the case Others/Market, where this figure only reaches 34.73%.

The feedback from the Market to Others is quite high (63.32%) while the inverse lagged feedback is marginal (1.95%). Moreover, when we include Others in the Market, the lagged feedback from the Market to Bitfinex is not significant at the 10% level. This corroborates the previous conclusion that Others doesn't has, on average, important information on the USD/BTC price movements. Given these results, we hereafter study the USD/BTC market formed only by Bitfinex, Bitstamp, BTC-e and ItBit.

**Where is the Information on USD/
 Bitcoin Hourly Prices?**

Table 4, Panel B, deserves special attention. The four exchanges are well integrated, with more than 75% of the information on prices being transmitted to the overall market within an hour. The feedback from Bitfinex and from Bitstamp to the Market is higher than the reverse feedback, while the opposite happens for BTC-e and ItBit. However, it takes more than an hour for transmitting 18.29% of the short run price movements that have its origin in Bitfinex, while the relative lagged feedback from Bitstamp is 10.10%. The feedback from the Market to Bitfinex and to Bitstamp is only 0.60% and 2.55%, respectively. In sum, one might say that Bitstamp is more integrated with the overall market, but Bitfinex has the short run informational dominance.

Now we analyse how the feedback measures relate to volatility and volume. As described before, we partitioned the sample into non-overlapping rolling windows and estimate the time series of feedback measures. We choose a window with an amplitude of 5 days, which means that the VARs estimates were obtained from subsamples of 119 returns observations. We get 201 estimates for each feedback measure.⁴ The estimation results are shown in Table 5.

Table 5: Panel regressions on the feedback measures

	$nF_{i \rightarrow j}$	$nF_{j \leftarrow i}$	$nF_{j \rightarrow i}$	$nF_{i,j}$
<i>Intercept</i>	4.0900*** (6.3539)	-21.091*** (-8.6080)	1.0296 (1.7039)	-16.4148*** (-7.5586)
HL_i	18.442*** (11.9094)	81.5885** (3.9798)	-6.4511** (-3.9287)	76.8656** (3.8838)
HL_j	-16.228** (-3.9841)	-65.268*** (-5.2993)	4.7885 (1.6733)	-57.726*** (-4.5083)
vol_i	0.0720 (0.8073)	1.5370*** (4.6319)	0.0070 (0.3557)	1.3934*** (4.6017)
vol_j	-0.1735** (-3.2619)	1.9216*** (6.0128)	0.1583* (2.4148)	1.646*** (5.6185)
$F_{(4,5)}$	75.058***	654.77***	16.883***	2026.9***
R^2	0.0234	0.4921	0.0215	0.5169

Notes: This table shows the panel regression results on the normalized feedback measures, namely the parameter estimates, the Arellano (2003) t-statistics adjusted for heteroscedasticity and serial correlation (in parentheses), the F test for joint significance of the “named regressors” and the within R^2 . The feedback measures were estimated, from fitted VAR models with a lag structure truncated at 5, for all pairs of exchanges, using hourly logarithmic returns for each sub-sample of 5 days. The feedback measures, multiplied by the number of observations, were then normalised. The panel regressions consider 201 time points for 6 cross-section units (each pair of exchanges) for a total of 1206 observations. The normalized lagged feedback from i to j and from j to i are denoted by $nF_{i \rightarrow j}$ and $nF_{j \leftarrow i}$, respectively, while the simultaneous feedback is denoted by $nF_{j \leftarrow j}$ and the total feedback is $nF_{i,j}$. Values significant at the 10%, 5% and 1% levels are marked by *, ** and ***, respectively.

⁴ Before we proceed with the panel regressions we test for unit roots in the series, with special attention to the log-volume series. The Im-Pesaran-Shin panel unit root test, with a constant, without trend or lags allows us to conclude that all series are stationary at the 1% level. Then we select the panel model using the Breusch-Pagan test on the null hypothesis of pooled regression and the Hausman test on the null hypothesis of consistency of the GLS estimates (random effects). All the statistics were significant at the 1% level, which led us to select the panel regression with fixed effects.

The joint test indicates that the overall feedback measures are significant at a 1% level, however the within coefficient of determination is quite low for the lagged feedbacks (around 2%), while its value for the contemporaneous and total feedbacks are 49.21% and 51.69%, respectively. The regressors in the lagged feedback from the major exchanges, $nF_{i \rightarrow j}$, have all the expected signs, however only the volatility in exchanges i is significant at the 1% level. The variables of exchanges j are significant at the 5% level. In the equation of the lagged feedback from the minor exchanges, $nF_{j \rightarrow i}$, the volatility in exchanges i has the expected sign and is significant at the 5% level, while volume in exchanges j has the expected sign and is significant at the 10% level. These results suggest that the main driving force behind the lagged feedback is the volatility in the major markets, extending the information transmission for more than an hour from the major exchanges and diminishing the reverse feedback. The regression results for the contemporaneous and total feedbacks are quite similar. In fact, the main difference is that the coefficients and the t-statistics in the total feedback are slightly lower. In these two regressions all the variables are significant at the 1% level, and both volume and volatility in the major exchanges contribute positively for the contemporaneous and total feedback. However, volatility in the minor exchanges has a negative sign implying that an increase in that volatility tends to diminish market integration (contemporaneous feedback) and the total linear interconnection between exchanges.

6. CONCLUSION

The present paper aims to analyse the price discovery process among all relevant exchanges in the USD/Bitcoin market with public available data, even those with low trading intensity. The data was collected from the site www.bitcoincharts.com and reflects the trading information on 14 exchanges for the period since the Mt.Gox bankruptcy until the aftermath of the hack attack on Bitfinex, i.e., since 01-Mar-2014 until 30-Nov-2016, for a total of 1006 days (24143 hourly observations). Given the traded volume and the period of trading, we decided to study Bitfinex, Bitstamp, BTC-e and ItBit separately, while aggregating the remaining 10 exchanges (Coinbase, LakeBTC, LocalBitcoins, Kraken, HitBTC, Onecoin, Rock, CampBx, BitKonan and Bitbay) into a basket, that we denominated by Others. The aggregating procedure uses the price index weighted by trading volume.

The Geweke feedback measures were then estimated pairwise between exchanges, using hourly returns (computed on price indexes weighted by volume) for the overall sampling period. The results highlight the existence of a positive relationship between the total feedback and market share of both exchanges but also with its proximity in terms of trading volume. Most of the information is transmitted between exchanges within an hour, at least for the main four exchanges, while lagged feedback runs mainly from the major exchanges in each pair, being its relative importance positively related to the difference in trading volumes. The minor exchanges, compiled into Others, seem to react to price information with some delay and are merely satellite exchanges.

The Geweke feedback measures were also estimated pairwise between each exchange and the rest of the market. The results supported the main conclusions stated above, namely that the consideration of minor exchanges only brings more noise into the price index process,

Bitstamp is well integrate with the overall market, but, more importantly, Bitfinex stands out as the most important exchange in transmitting information to the market: the relative importance of the lagged feedback from Bitfinex to the market is 18.29% while that quantity for the lagged feedback from the market to Bitfinex is only 0.60%.

The panel regression of the feedback measures on volatility and volume shows that these variables explain a fair part of the contemporaneous and total feedback, with all the signs being significantly positive except the volatility in the minor exchange. This result suggests that pairwise, in relative terms, the volatility in the major exchange is mainly information-based, aligning exchanges together, while volatility in the minor exchange is more noise-based, driving exchanges apart. For the lagged feedback, the most important explaining variable is the volatility in the major exchange, which has an obvious different impact: an increase in that volatility increases the feedback from the major exchange while decreases the feedback from the minor exchange.

Trading Bitcoins involves an important operational risk (the history of Bitcoin exchanges is replete of events such as hack attacks, missing wallets, malpractices, government interventions, temporary and not so temporary trading halts, etc.) and the market industrial organization is in permanent evolution. Therefore, our results are conditional on the sampling period. In fact, it would be quite interesting to see if the informational superiority of Bitfinex still exists after the hack attack occurred on Aug-2016.

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THE POLITICAL ECONOMY OF PENSION SYSTEMS WITH LOW-SKILLED LABOR MOBILITY: A CROSS-COUNTRY ANALYSIS

Ana Fontoura Gouveia

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ABSTRACT

This paper analyzes the impact of international low-skilled labor mobility on the majority support for a pension system in individual countries and on the welfare of the different agents. The two countries considered differ in the amount of redistribution from the high to the low-skilled population embedded in their pay-as-you-go social security systems, whose size (tax rate) is decided by majority voting, anticipating the impact on mobility. We show that labor mobility can create the conditions for a majority to favor pensions in a Bismarckian country, due to the ageing of the population caused by the departure of the young mobile. In a Beveridgean country, mobility does not necessarily undermine the support for the system, but may make the conditions for its existence more stringent, even if no individual migrates in equilibrium. Finally, we show that while labor mobility is always politically sustainable in the non-redistributive country, its political feasibility is at stake in the country performing income redistribution through the pension system whenever the interest rate is not sufficiently large.

Keywords: Pension systems; labor mobility; fiscal competition; political economy.

JEL Classification: H55; R23; D72; H73.

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1. INTRODUCTION

Most pension systems and, more broadly, the welfare systems in European Union countries were introduced in the turn from the 19th to the 20th century and were consolidated in the 1950's, in a context where the integration of markets was just beginning. Today, at the European Union level, free mobility of goods, services, capital and labor is increasingly a reality. Nevertheless, despite the significant achievements so far, the European integration is still hampered by different national regulations, non-harmonized national taxation policies and national welfare systems.¹ Social security policy decisions remain a national responsibility and the most ambitious EU-wide initiatives entail a great degree of flexibility, like the so-called Open Method of Coordination.

This integration has important implications for national policies. In particular, when designing a national pension system with integrated markets, one must take into account not only the objectives and sustainability of the system (as with non-integrated markets), but also the incentives that the different national designs create in different markets, in particular the factors markets. Standard fiscal competition literature would advise that the relevant market of the tax base should determine the level of government at which the policy is set up. Asymmetric systems, size and redistribution-wise, may therefore impact the allocation of labor and impact the welfare of the agents and of countries in non-expected ways. Two questions then arise: is labor mobility empirically relevant in the EU context? And how different are the EU pension schemes?

On the first question, it is sometimes argued that despite the theoretical free mobility of labor, barriers (like cultural differences, for example) are still dominant. According to European Commission (2013), net migration is the main driver of population growth in the EU. In fact, in 2011 the natural increase of the population contributed to only one-third of the population growth in the EU. In the same year, migrants from other EU countries represented 3.4% of the EU population, with the situation varying greatly from country to country (migration from countries outside the EU accounted for 6.6%). The relevance of the mobility of labor within EU countries is, therefore, non-negligible. However, migration entails both pecuniary and non-pecuniary costs (settling costs, being far from home, learning a new language). Thus, mobility induced by different welfare systems (in our case, the pension system) arises only if the potential benefits are significant. Wildasin (1997) estimated the net public pension wealth (negative for net contributors to the system and positive for net beneficiaries) for some EU countries and concluded that, for particular combinations of origin and destination countries, the gains of moving from one country to the other may reach 25% of lifetime wealth. There is indeed evidence that welfare is one of the factors contributing to labor mobility (see, for instance Meyer, 2000, and Giorgi and Pellizzarib, 2009) and welfare-induced migration has been widely discussed by the public opinion in countries such as the UK or Germany.

On the second question, the European Union is also a good example of asymmetric pension systems. Even if one may speak of an European social model with distinctive features

¹ In addition to this, even the single currency or the Schengen convention are not applied uniformly across the European Union.

from the rest of the world (as discussed, for example, in Cousins, 2005: 239-241), we are far from a common European welfare state. The welfare states in the EU remain a national responsibility and, as we will see next, they differ substantially across countries, both in size and in level of redistribution.

In our analysis, we focus on public pensions given “the prominent role of the State in pension provision in the EU countries” (European Commission, 2015).

Table 1 displays the size of public pension systems, measured by the share of expenditure in the GDP. Public pensions have a significant weight on EU economies, surpassing 11% of GDP for the EU28. And the situation is quite diverse at country level: the country with the highest share (Greece) spends more than twice as much as the country with the lowest share (Netherlands).²

Table 1: Public pensions expenditure as a share of GDP in 2013, EU countries

Netherlands	6.9	Luxembourg	9.4	Slovenia	11.8
Lithuania	7.2	Cyprus	9.5	Spain	11.8
Ireland	7.4	Malta	9.6	Finland	12.9
Estonia	7.6	Bulgaria	9.9	Portugal	13.8
United Kingdom	7.7	Germany	10.0	Austria	13.9
Latvia	7.7	Denmark	10.3	France	14.9
Slovakia	8.1	Croatia	10.8	Italy	15.7
Romania	8.2	Poland	11.3	Greece	16.2
Sweden	8.9	Hungary	11.5	EU28	11.3
Czech Republic	9.0	Belgium	11.8	Euro Area	12.3

Source: European Commission (2015).

There are also important differences across countries regarding the redistributive nature of the public pension systems. A fully Beveridgean system provides a flat rate pension, whereas a fully Bismarckian system is purely earnings-related. In the EU, “in a few Member States, notably in Denmark, the Netherlands, Ireland and the United Kingdom, the public pension system provides in the first instance a flat-rate pension, which can be supplemented by earnings-related private occupational pension schemes (in the UK, also by a public earnings-related pension scheme State Second Pension and in Ireland by an earnings-related pension scheme for public service employees)”.³ Table 2 shows that only five countries allow for the same replacement ratios for high and low earners (namely Germany, Hungary, Italy, Poland and Spain). In all the other countries presented, low earners have

² It should be noted that pensions are not only provided through public systems and thus the inclusion of private pension schemes, which are significant in some countries, may give a different picture.

³ European Commission (2015).

higher replacement ratios. In countries such as Ireland and Denmark the difference is as high as 50 percentage points.⁴

Table 2: Gross pension replacement rates in 2013 (difference between high and low earners), subset of EU countries

	Public schemes	Total mandatory		Public schemes	Total mandatory
Denmark	-50.0	-56.2	France	-17.3	-17.3
Ireland	-48.9	-48.9	Portugal	-13.4	-13.4
Netherlands	-39.4	-5.0	Slovak Republic	-10.8	-10.8
Czech Republic	-37.7	-37.7	Finland	-9.4	-9.4
United Kingdom	-32.7	-32.7	Austria	-2.6	-2.6
Greece	-28.7	-28.7	Germany	0.0	0.0
Belgium	-28.0	-28.0	Hungary	0.0	0.0
Slovenia	-25.3	-25.3	Italy	0.0	0.0
Luxembourg	-24.7	-24.7	Poland	0.0	0.0
Sweden	-22.9	-2.3	Spain	0.0	0.0
Estonia	-17.4	-17.4	EU27	-17.8	-16.0

Source: OECD (2013). OECD pension models: difference between replacement rates of two workers making, respectively, 150% and 50% of the average worker earnings, in percentage points. Replacement rates are expressed in percentage of individual earnings.

In terms of financing of the public pension system, pay-as-you-go (PAYG) is the most common approach (European Commission, 2015). In a PAYG setting, the mobility of labor entails different effects depending on the direction (emigration vs. immigration), skill composition and size of the migration flow.⁵

2. RELATED LITERATURE

There is an extensive literature analyzing both intergenerational (across generations) and intragenerational redistribution (across income levels). An interesting example of the first is Homburg and Richter (1993), who propose an OLG model in a multi-jurisdiction setting with

⁴ Only in two countries, the Netherlands and Sweden, the inclusion of all mandatory schemes significantly reduces the differences between high and low earners. In Denmark, the difference increases. For all the other countries, there is no difference.

⁵ The integration of capital markets is particularly interesting in a context where the financing of the systems differs from one country to the other, namely to study the interaction of PAYG and fully funded (FF) schemes. See, for example, Casarico (2000) for competing PAYG and FF systems or Pemberton (2000), for the analysis of the shift from PAYG to FF. Competing PAYG systems may also be studied in a context of integrated capital markets, as in Pemberton (1999).

integrated markets. Households are homogeneous, ruling out redistribution across income levels, and the PAYG pension scheme is designed with exogenous and time invariant pension contributions (pension benefits adjust passively to ensure the balancing of the system). They conclude that only a centralized pension system is efficiency preserving. Breyer and Kolmar (2002) build on this work, showing that the harmonization of contributions is not only a necessary condition (as shown before by Homburg and Richter, 1993) but also a sufficient one to ensure efficiency. They further extend the model to allow for mobility costs, finding much more restrictive conditions for an efficient allocation of resources.

Cremer and Pestieau (1998) develop a static model of intragenerational redistribution, to study the political economy of social insurance, introducing the so-called Bismarckian factor. The type of social insurance, with Bismarckian and Beveridgean systems at the extremes, is chosen at a constitutional stage (behind the veil of ignorance) and the tax rate to finance the system is then decided through majority voting. They conclude that the type of mobility (poor vs. rich) plays an important role on the tax competition outcome. Furthermore, at the constitutional stage countries adopt more than optimal Bismarckian systems but these systems are not necessarily more tax competition proof. Cremer and Pestieau (2003) study the sustainability of Bismarckian and Beveridgean systems within an economic union when the low-skilled are mobile. They show that, in general, low-skilled move to the Beveridgean country. Only in a setting where the rich in the Bismarckian country do not participate in the system and the Beveridgean country offers no social insurance, it is possible that all poor households move to the Bismarckian country. In both papers, wages are fixed.⁶

Razin and Sadka (2000) and Kolmar (2007), building on the literature of static settings, develop dynamic models thereby combining inter and intragenerational redistribution. They work in a setting with fixed factor prices and exogenously given time invariant tax rates. In the first paper, migration is a one-time episode, of a given fixed amount. With fixed factor prices, the authors show that an in flow of low-skilled workers is beneficial for all skill levels and for young and old households. However, with flexible factor prices, the result does not necessarily hold for the young (through simulations, the authors show that the low-skilled young loose but the young high-skilled, in a large open economy setting and for certain parameters, may still gain). Kolmar (2007) extends the static analysis in Cremer and Pestieau (2003) to a dynamic setting, confirming the main results: under reasonable assumptions and parameters, low-skilled agents move to the Beveridgean country.⁷

With endogenous tax rates, the future pension depends on the unknown future tax rate and thus the households' budget constraint is ill-defined. Boldrin and Rustichini (2000) have shown the rather restrictive conditions needed to guarantee equilibrium in an OLG setting. To circumvent the problem, more applied contributions suppose that the future tax rate is either taken as given by the voters (Tabellini, 2000) or fixed forever (Casamatta et al, 2000b). Conde Ruiz and Profeta (2007), building on Conde Ruiz and Galasso (2003 and 2005) show that the results of the one-time voting can be generalised to a repeated game, with a system of punishment and rewards.

⁶ For a model without labor mobility, please refer, for instance, to Casamatta et al. (2000a).

⁷ For models without labor mobility, see, for instance, Conde Ruiz and Profeta (2007) and Casamatta (2000b).

In this paper, we build on the dynamic models developed by Razin and Sadka (2000) and Kolmar (2007) and introduce a voting stage over the tax rate that finances the pension system. Also, we introduce non-myopic voters to this dynamic setting, i.e. voters that take into account the impact of their voting choice on mobility incentives.⁸

With this model we aim at answering two research questions. First, we want to understand the conditions under which the pension systems are politically sustainable and the impact of cross-country low-skilled labor mobility on these voting equilibria. Second, we want to assess the impact of mobility on the welfare of the different agents, allowing us to ascertain the conditions for free low-skilled labor mobility to be politically feasible.

The remainder of the paper is organized as follows. Section 3 presents the model. In Sections 4 and 5 we derive the migration and the voting equilibria and in Section 6 we assess the welfare impact of mobility. Finally, Section 7 concludes.

3. THE MODEL

We build an overlapping generations model with two small open economies, integrated in the world capital markets. The countries are symmetric except for the type of public pension system - one is Bismarckian, with pensions related to earnings, and the other is Beveridgean, providing at pensions and performing income redistribution. The national public pension systems are endogeneized, with voters choosing the tax rate that finances it. As in Cremer and Pestieau (2003), low-skilled labor is mobile.⁹ Voters have perfect foresight, in the sense that they incorporate the mobility incentives in their voting decisions.

The timing of our model is as follows: first, agents vote on their preferred tax rate, which is chosen once and forever (as in Casamatta et al, 2000b); then, in the beginning of their working lives, mobile workers move to the country that ensures higher welfare¹⁰; finally, the young agents of each country work in their country of residence. If a pension system exists, they pay taxes that are used to finance the pensions of the old. The retirement benefit is paid by the country where the individual worked during the first period of life and where she paid her contributions.¹¹

⁸ For a modelization of non-myopic voters in a static setting, please refer to Cremer and Pestieau (1998) and Epple and Romer (1991).

⁹ As presented in OECD (2012), low-skilled workers represent, in general, the largest share of foreign-born population in the EU countries.

¹⁰ We assume that agents vote before mobility, in their home country. This is in line with the current setting of the European Union, where voting is mainly linked to citizenship and migrants have limited voting rights. Migrants from other EU-countries are allowed to vote in local and European elections only. Even in the presence of voting rights, effective participation varies greatly among EU countries. Third-countries migrants (i.e. migrants from outside the EU) have even more restricted voting rights. In addition, the share of migrants acquiring citizenship in the EU (that entitle them to voting rights) is very limited. In 2009, it was less than 3%, ranging from 0.3% in Czech Republic to 5.8% in Portugal (Eurostat, 2011: 247).

¹¹ This is in line with the current framework within the European Union (the residency principle, as opposed to the origin principle). This is also the reason why we can disregard mobility after retirement, since pensions will always be paid by the countries where the household worked. If we think of sources of heterogeneity between countries

3.1. THE HOUSEHOLDS

In each country (A , the Bismarckian, and B , the Beveridgean) there are two types of workers, the high (h) and the low-skilled (l). The autarchy ratio of young to old agents (henceforth the autarchy inverse dependency ratio) is given by the constant rate $1 + n$. In terms of voting coalitions, our demographic assumptions are that the young outvote the old ($n > 0$) and that the young low-skilled plus the old outvote the young high-skilled.¹²

If the voter is indifferent across tax rates, she decides not to vote (implicitly assuming that there is an infinitesimal cost of casting a vote). Households can also vote with their feet, by moving to the other country in the beginning of their working lives. We assume that, when indifferent, they do not migrate. We follow Cremer and Pestieau (2003) and assume that only low-skilled workers are mobile.¹³

The households live for two periods. When young (period 1) they work (supplying inelastically one unit of labor), contribute to the pension system and save or borrow; when old (period 2) they retire, receive a pension benefit and consume (pay) their savings (loans), plus interest.¹⁴

The households' lifetime utility is given by:¹⁵

$$U_t^i = \ln c_t^i + \beta \ln d_{t+1}^i, \quad i = h, l \quad (1)$$

where c and d denote, respectively, consumption in the first and second periods of life and represents the intertemporal discount factor. For tractability reasons, we will assume that $\beta = 1$.

The household budget constraints are given by:

$$c_t^i = w_t^i(1 - \tau) - s_t^i, \quad i = h, l \quad (2)$$

$$d_{t+1}^i = s_t^i R_{t+1} + p_{t+1}^i, \quad i = h, l \quad (3)$$

where w represents the wage (there are different wages for the different skill levels), R the market return, s are savings, τ is the tax rate paid by the young to finance the pension system and p is the pension received upon retirement by the old.

others than the pension schemes (different VAT rates, health system, climate), then the old may as well have incentives to move.

¹² These assumptions are in line with Eurostat data: for the EU28, in 2014 the high-skilled, i.e. those with a least tertiary education, represent only 26% of the working age population (aged 15 to 64); also, there are around 28 people aged 65 or more for each 100 working age agents.

¹³ Other options may be found in the literature: for example, Cremer and Pestieau (1998) analyze both types of mobility separately in a static framework with fixed wages, while Kolmar (2007) considers mobility of high and low-skilled simultaneously with fixed factor prices and exogenous tax rate.

¹⁴ In order to isolate the effects of pension schemes, distortions coming from the labor-leisure choice are assumed away.

¹⁵ For simplicity of notation we henceforth omit the country index. We will return to the country indexes whenever interpretation is not straightforward.

3.2. THE FIRMS

Firms are perfectly competitive and produce a single homogeneous good according to a common, time invariant constant returns to scale (CRS) production function that uses both capital and labor, $F(k_p, L_t)$, respecting the Inada conditions. Labor in each country is measured in efficiency units:

$$L_t = aN_t^h + N_t^l, \quad a > 1, \quad (4)$$

where a denotes the productivity of the high-skilled (henceforth, the “skill premium”), common to both countries, and N_t^l and N_t^h represent the low and high-skilled population, respectively. For future reference θ_t represents the ratio of low- to high-skilled agents. In particular, θ_t^a stands for the autharchy ratio θ_t^m represents the migration equilibrium fraction of low- to high- skilled agents and $\bar{\theta}_t^a$ reflects the maximum θ , that is, a situation where all low-skilled moved to one country.

Profit maximization implies that marginal productivities match factor prices, namely the internationally given interest rate R and the wage level, w . Note that $aw^l = wh$. We can omit the time subscript as with two small open economies with CRS, the Capital-Labor ratio K/L remains constant. This also means that mobility has no impact on productive efficiency and we are able to focus solely on redistributive motives for mobility.

3.3. THE GOVERNMENT

In each country, the government provides pensions to the old households that worked in the country financed by the contributions of the young residents (the so-called Pay-As-You-Go system). Country A is purely Bismarckian, providing earnings related pensions, whereas country B is purely Beveridgean, providing a flat pension, equal across income levels. The pension level that guarantees a balanced government budget (i.e. total contributions in a given period match total pensions paid in that same period) is:

$$p_{t+1}^{A,i} = \tau\omega^i \frac{L_{t+1}}{L_t}, \quad i = h, l \quad (5)$$

$$p_{t+1}^B = \tau\bar{\omega}_{t+1} \frac{N_{t+1}}{N_t}, \quad (6)$$

where w represents the average wage:

$$\bar{\omega}_{t+1} = \frac{N_{t+1}^h w^h + N_{t+1}^l w^l}{N_{t+1}} = w^l \frac{L_{t+1}}{N_{t+1}} \quad (7)$$

and $N_t = N_t^h + N_t^l$.

The tax rate determines the size of the pension system: the larger the tax rate, the bigger the system. In addition to the tax rate, pensions in both countries increase with the inverse dependency ratio (which is affected by mobility). They are also affected by the wage level: in the Bismarckian country pensions increase with the individual wage level (hence, for the high-skilled, with the skill premium a) while in the Beveridgean country the pension increases with the average wage (which increases with the wage level and the skill premium and decreases the higher the proportion of low-skilled). We implicitly assume that any adjustments to the pension system to ensure its sustainability (i.e. that the system is balanced) are accommodated on the benefit side (the pension level) and not on the contribution side (given that the tax rate is fixed).¹⁶

Throughout the paper we make the conservative assumption that $R > 1 + n$. This ensures that, absent redistribution and political economy motives, pension systems would not exist.

3.4. VOTING WITH IMMOBILE LABOR

As a benchmark, we present the voting decisions when labor is immobile. The motivations of the voters are useful to understand what happens when mobility is introduced.

In order to find the voting equilibrium, we turn to the households maximization problem. In period t , the representative household maximizes lifetime utility (1), subject to the budget constraints (2) and (3) and, also, subject to the pension offered in her country, (5) or (6). As stated before, voters are non-myopic in the sense that they take into account migration incentives in their voting decisions.

When labor is not mobile, N_{t+1}/N_t and L_{t+1}/L_t are both equal to the inverse autarchy ratio of young to old agents ($1 + n$), the autarchy dependency ratio. Old agents always favor the largest possible system as they are not subject to the pension contribution tax.

Turning to the young generation, it is immediate that having a pension system is never a good deal, except if redistribution across incomes compensates the returns differential. This can only happen for low-skilled in the Beveridgean country when:

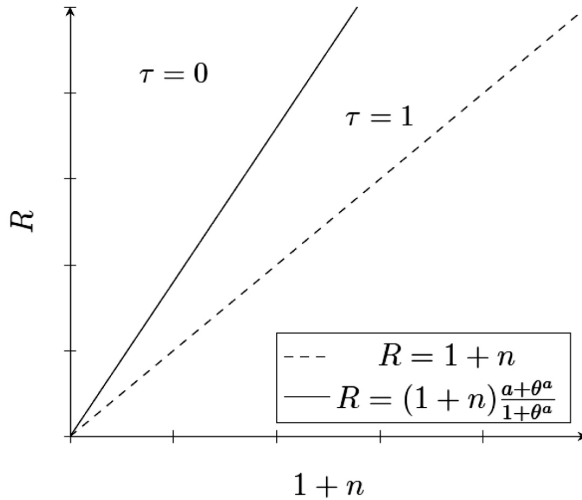
$$\frac{\bar{\omega}_{t+1}}{\omega^i} (1 + n) > R, \quad (9)$$

which can be re-written as:

$$R < (1 + n) \frac{a + \theta_{t+1}^a}{1 + \theta_{t+1}^a}, \quad (10)$$

¹⁶ An alternative to formulation (5), which still ensures a balanced government budget, is to consider that the different types of workers (high- and low-skilled) contribute to separate systems: $P_{t+1}^{A,i} = \tau \omega^i \frac{N_{t+1}^i}{N_t^i}$, $i = l, h$ (8). This does not seem to be the case in most systems and, thus, we focus on the formulation given by (5).

Figure 1: Voting of the young low-skilled in the Beveridgean country without labor mobility



where θ_{t+1}^a represents the autharchy ration of low to high-skilled agents. Figure 1 displays the voting decisions of young low-skilled in the Beveridgean country. The higher the skill premium and the lower the ratio of low- to high-skilled households, the more likely it is for the young low-skilled to support the system (the solid black line rotates to the left). This happens because the gains from redistribution also increase.

Condition (10) is sufficient to ensure a pension system in the Beveridgean country: the young high-skilled, that vote against the system, are outvoted by the young low-skilled plus the old.

In a nutshell, in the absence of labor mobility, the Bismarckian country never provides pensions. The Beveridgean country has a pension system if and only if the gains from income redistribution for the young low-skilled are sufficiently high.

For future reference, let us discuss which country better suits the different agents. First, note that if there are no pension systems, the countries are equal in all respects and thus the utility of each agent type is the same across countries. If the Beveridgean offers a pension system, then the old are better-off in that country as they see their utility increased. For the young, it depends on their net contribution to income redistribution: the young low-skilled fare better in the Beveridgean whereas young high-skilled have higher utility in the Bismarckian.

4. MOBILITY EQUILIBRIUM

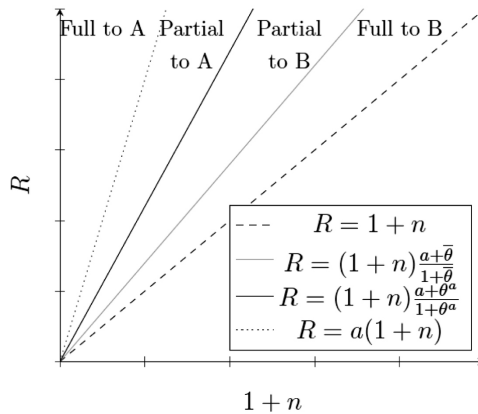
We now consider that the low-skilled can freely move between the two countries. It turns out that, when the Beveridgean adopts a pension system, the low-skilled may migrate to the Bismarckian country (if the Beveridgean does not offer a pension system, there is no mobility as there is no system in either country). This is summarized in Proposition 1.

Proposition 1 (Mobility equilibrium when the Beveridgean offers a pension system – exogenous pension size). Consider two small open economies, a Bismarckian and a Beveridgean country. When the size of the pension system is exogenous, low-skilled may flow in either direction. There is migration from the Beveridgean to the Bismarckian when income redistribution is too low to compensate for the low market returns, that is, $R > (1 + n) \frac{a + \theta^a}{1 + \theta^a}$.

The mobility equilibria are presented in Figure 2.¹⁷

The mobility equilibrium depends on four parameters: the skill premium, a , that, together with the ratio of low- to high-skilled agents, determines the degree of redistribution across income levels; the inverse autarchy dependency ratio, $1 + n$, that determines the redistribution across generations. Note that the higher or lower number of contributors to the system due to mobility only affects the current generation of pensioners; by the time the current young retire, the dependency ratio is back to its natural level. And, finally, the international interest rate (R) that represents the returns on market investments.

Figure 2: Mobility equilibria, direction and size of migration of low-skilled young when the Beveridgean offers a pension system



¹⁷ Note that the number of low-skilled cannot be negative (zero is the lower-bound, which implies that all young low-skilled moved out of the country) nor can migration exceed the sum of the total number of agents of that skill-type in the two countries (which occurs when all low-skilled move to the country). These conditions imply that $0 \leq \frac{R - a(1 + n)}{1 + n - R} \leq \bar{\theta}^B$, where $\bar{\theta}^B = \frac{N^{A+B,l}}{N^{B,b}}$

As we show next, if the Beveridgean country offers a pension system, then the young low-skilled move to the Bismarckian country as long as income redistribution is too low to compensate for the low market returns. Conversely, for sufficiently high income redistribution compensating for the lower market returns, the young agents move to the Beveridgean country. When redistribution is sufficiently high (respectively, low), all low-skilled live in the Beveridgean country (respectively, Bismarckian country).

To arrive to these results, we have to first assess what happens in the Bismarckian country, where the voting decision of the young is not affected by mobility. In fact, the way mobility affects the young agents is through its effect on the average wage. In that country, the average wage does not play any role and, therefore, for young agents the preferred tax rate is $\tau = 0$.¹⁸ For old agents, the preferred tax rate depends on mobility, which determined the number of contributors to the system. However, as long as there is no full migration to the Beveridgean country, the young still form a majority and there is no pension system in the Bismarckian. The exception is when all the young low-skilled of the Bismarckian move to the Beveridgean – we discuss this case later.¹⁹

For the moment, let us focus on the case where the Bismarckian country does not have a pension system and find the equilibria in the Beveridgean country. A mobile agent compares the utility she may get in the two countries. In the Bismarckian country, utility is given by:

$$U_t^{A,l} = \ln(w^l \frac{1}{2}) + \ln(w^l R \frac{1}{2}), \quad (11)$$

where we have used the optimal saving decision.

Utility in the Beveridgean country can be written as:

$$U_t^{B,l} = \ln(w^l(1-\tau^B) - S_t^{B,l}) + \ln(S_t^{B,l} R + \tau^B \bar{\omega}_t(1+n)), \quad (12)$$

where, from the first order conditions of the household maximization problem, savings are given by:

$$S_t^{B,l} = w^l \frac{[R(1-\tau^B) - \tau^B \frac{L_t^B}{N_t^B}(1+n)]}{2R}. \quad (13)$$

If the pre-mobility utility in the Bismarckian is larger (smaller) than in the Beveridgean, then low-skilled agents move to the Bismarckian (Beveridgean). In equilibrium, utilities in both countries are equalized, unless all low-skilled agents locate in one of the countries.

¹⁸ We recall that $R > (1+n)$.

¹⁹ These mobile workers are indifferent about the tax rate of their origin country and thus do not cast a vote. In this context, the majority coalitions may change. Whenever this is true, we discuss the conditions for a new equilibrium in the Bismarckian country.

An interior migration equilibrium is given by the equalization of utility levels as given by (11) and (12):

$$\mathcal{N}_t^{B,l} = \mathcal{N}_t^{B,h} \left(\frac{R - a(1+n)}{1+n-R} \right) \quad (14)$$

or

$$\theta_t^{B,m} = \frac{R - a(1+n)}{1+n-R}, \quad (15)$$

where θ^m represents the equilibrium fraction of low- to high- skilled agents. Expressions (14) and (15) define an interior equilibrium, which arises when:

$$R \in (1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}}, (1+n). \quad (16)$$

If R is below the lower bound, all low-skilled move to the Beveridgean country. If R exceeds the upper bound then all low-skilled migrate to the Bismarckian.

5. VOTING EQUILIBRIUM

In this section we show that three voting scenarios may arise when labor is mobile: no pension system in either country; a pension system only in the Beveridgean; or a pension system in both countries, the latter an outcome which was not possible in the no mobility case. These results are summarized in Proposition 2.

Proposition 2 (Impact of mobility on voting). Consider two small open economies, a Bismarckian and a Beveridgean country, with endogenous tax rates and non-myopic voters. Mobility changes the size of the pension system. In particular, whenever $R < (1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}}$ and the old outvote the young high-skilled, mobility allows for the creation of a pension system in the Bismarckian country (which would not exist with immobile labor); whenever $R < (1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}} < R < (1+n) \frac{a+\theta^a}{1+\theta^a}$ and the young high-skilled outvote the old, mobility implies that there is no pension system in the Beveridgean country (which would exist with immobile labor). This result holds even though, under these conditions, no mobility occurs in equilibrium.

For the Bismarckian country, only with labor mobility can a pension system exist. In the Beveridgean country, labor mobility makes the conditions for the existence of the system (weakly) more stringent. It is interesting to note that mobility may have an impact on the

existence of the pension system even for those cases where households choose not to migrate. Under the conditions of Proposition 2, the tax rate in the Beveridgean country changes from $\tau = 1$ to $\tau = 0$ because the threat of an in ow of low-skilled from the Bismarckian to the Beveridgean in case of $\tau > 0$ makes the young low-skilled of the Beveridgean indifferent across all possible tax rates (as $\tau = 0$) with no mobility provides them the same utility as any other $\tau > 0$ with in ow mobility) and thus they have no incentive to cast a vote.

The results of the mobility equilibrium with endogenous pension size are summarized in Proposition 3 and can be directly derived from Proposition 1 together with the outcome of the voting equilibrium discussed above.

Proposition 3 (Mobility equilibrium with endogenous pension size). Consider two small open economies, a Bismarckian and a Beveridgean country, with endogenous tax rates and non-myopic voters. If R is sufficiently high, $R > (1+n)\frac{a+\theta^a}{1+\theta^a}$, there is no pension system in the Beveridgean country and no mobility occurs. If R is not sufficiently high, low-skilled move to the Beveridgean country.

To arrive to the conclusions presented in Proposition 3, we first determine the voting equilibria in the Beveridgean country using (14) and the results of the mobility analysis of the previous subsection. Note that mobility does not depend on the tax rate - as long as it is positive, the incentives to move depend solely on the possible gains from income redistribution. Thus, old agents vote for the maximum tax rate ($\tau = 1$) and young high-skilled agents vote for no pension system ($\tau = 0$), as they do in closed economy. For the low-skilled, there are three possible outcomes (summarized in Figure 3).

When low-skilled agents have an incentive to move to the Bismarckian country if the tax rate in their home country is positive, they always prefer to stay and vote for $\tau = 0$. This yields the same final utility as if they would move. Thus, there is no pension system in the Beveridgean country, as the young outvote the old.

If the migration equilibrium is interior with in ow into the Beveridgean, the young low-skilled of the Beveridgean are indifferent amongst tax rates in their country since they are not affected by it (their final utility is the utility of the other country, which does not change with mobility) and thus they have no incentive to cast their vote. The voting outcome depends on the relative number of young high-skilled and old: if the young high-skilled outvote the old there is no pension system; otherwise, it is $\tau = 1$.

Finally, if the migration equilibrium is a corner solution with full migration to the Beveridgean country, young low-skilled agents of the Beveridgean are not indifferent between tax rates as they stay in their home country. This happens when redistribution is sufficiently high; hence, they vote for $\tau = 1$. There is then full mobility from the Bismarckian to the Beveridgean country. Young low-skilled from the Bismarckian do not vote, as they get the utility of the other country. In that case, the voting equilibria in the Bismarckian country remains unchanged (i.e. no pension system) if and only if the young high-skilled of that country outvote the old. If, conversely, the old outvote the young high-skilled, then the tax rate $\tau = 1$ constitutes the new equilibrium in the country. Do the young low-skilled agents still want to move to the Beveridgean, in case the Bismarckian offers a pension system? The answer

is yes – if they would all move in their best case scenario (i.e. a tax rate equal to zero), the result is only reinforced with the new tax rate. In the Beveridgean country, this new voting equilibrium has no impact as the only thing that matters is that all young low-skilled move to the country if there is a pension system in the Beveridgean (and the final utility is higher than in the other country). Given that those in favor of the system form a majority (young low-skilled plus the old), the voting outcome in the Beveridgean is $\tau = 1$ (and there is full mobility to the Beveridgean).

Figure 2 can now be updated with the voting results discussed above. As summarized in Figure 4, a pension system never exists in the Beveridgean country when the return of the market is sufficiently high $R > (1+n)\frac{a+\theta^a}{1+\theta^a}$ and, therefore, no mobility takes place. Endogenizing the pension system thus implies that whenever mobility occurs the flow goes from the Bismarckian to the Beveridgean country.

Putting together the results of Propositions 2 and 3, one sees that even when there is no mobility in equilibrium, the pension system may no longer be feasible in the Beveridgean country. In addition, in the Bismarckian country, a pension system can only exist if the country becomes older, by having all the mobile young leaving to the Beveridgean.

Figure 3: Voting of the young low-skilled in the Beveridgean country with labor mobility

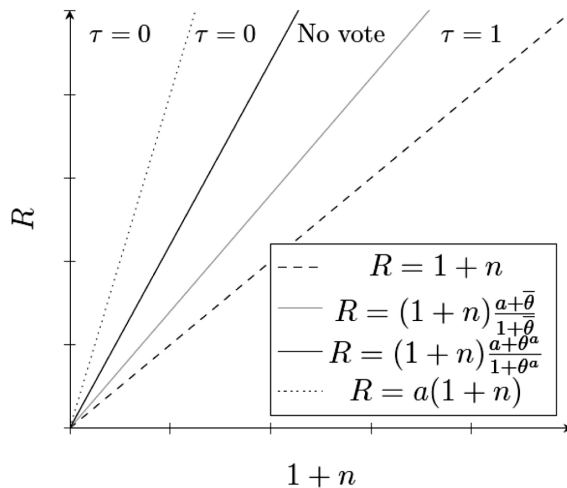
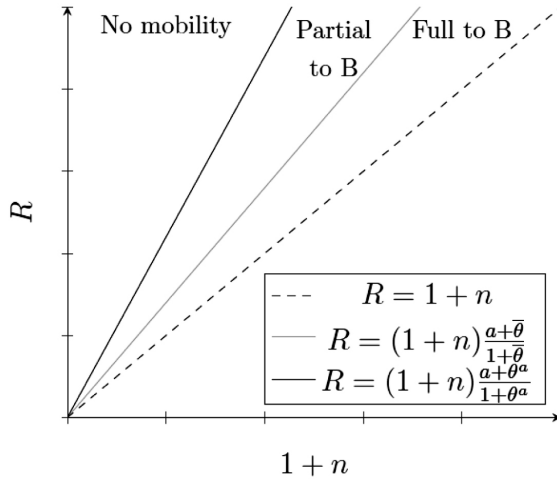


Figure 4: Mobility equilibria with endogenous pension size and the Beveridgean offers a pension system: direction and size of migration of low-skilled young



6. WELFARE ANALYSIS

Finally, we assess the welfare associated with the different voting and mobility equilibria studied above.

6.1. WHICH COUNTRY BETTER SUITS THE DIFFERENT AGENTS?

We start with a comparison of the level of welfare obtained by the different types of agents. Are the agents of one country better-off than the agents of the other country?

Mobility ensures that all the young low-skilled agents enjoy the same utility.²⁰ The interesting question relates to the relative welfare of the young high-skilled and the old. Table 3 summarizes the results.

Without a pension system in the two countries, the utility levels are equal across countries. If only the Beveridgean adopts a pension system, the young high-skilled of that country are always worse-off than their counterparts in the Bismarckian country that do not have to pay for income redistribution. Concerning old agents, the old of the country with pensions

²⁰ This happens because they either all locate in the same country or they get the same utility in both countries, the latter because they equalize cross-country utility levels by moving or because neither country offers a pension system.

are better-off than the ones in the country that does not provide pensions, where they get no old-age benefit.

If the two countries adopt a pension system, there is full mobility to the Beveridgean. As before, the young high-skilled are better-off in the Bismarckian country, without income redistribution. Conversely, the old low-skilled of the Beveridgean are better-off than their counterparts in the Bismarckian as they have a pension based on the average wage (and not on their type wage) and have more contributors to the system (all low-skilled moved to the Beveridgean). Finally, the comparison between the utility of an old high-skilled depends on the trade-off between number of contributors and pensionable wage – for a large enough skill premium, the pensionable wage effect dominates; if the skill premium is not large enough, the number of contributors effect dominates.

6.2. POLITICAL FEASIBILITY OF CROSS-COUNTRY LABOR MOBILITY

Finally, we assess the impact of labor mobility on the welfare of the natives of the different countries: who are the winners and the losers of opening the borders to low-skilled labor? The goal in this section is to understand the conditions for mobility to be politically feasible, i.e. when a majority of agents is not harmed with the low-skilled worker flows (as it would undermine the necessary political support). The question of the impact of low-skilled migration has been widely debated in the context of the EU, with some countries assessing the possibility of closing their borders to other EU countries or at least to increase migration restrictions.

Our results are summarized in Proposition 4.

Proposition 4 (Impact of mobility on welfare). Consider two small open economies, a Bismarckian and a Beveridgean country, with endogenous tax rates and non-myopic voters. Then, whenever $R < (1+n)\frac{a+\theta^a}{1+\theta^a}$, here is always a majority in the Beveridgean country against cross-country low-skilled labor mobility. In the Bismarckian country there is never a majority against cross country low-skilled labor mobility. Furthermore, whenever $R < (1+n)\frac{a+\bar{\theta}}{1+\bar{\theta}}$ those benefited from mobility outvote those against it.

For young agents, mobility affects two critical factors. The first is the size of the relevant pension system. The relevant pension system is the home country for those that do not move and the host country for those that move. The tax rate to which the agents are subject may change because the agents move to a country with a different tax rate but also because mobility changes the voting equilibrium. The second factor is the pensionable wage of the Beveridgean country. In that country, the pensionable wage is the average wage, which depends on the relative number of low- and high-skilled agents working in the country.

For old agents, in addition to the two factors already mentioned for the young population, there is a third critical factor, namely the flow of migrants, which impacts the ratio of

contributors to beneficiaries. This is irrelevant for the young, as migration occurs when they are young; their children are the ones who pay for their pensions and thus all that matters for them in this respect is the natural inverse dependency ratio, $1 + n$.

Table 4 summarizes the results. In a nutshell, cross-country low-skilled labor mobility is always politically feasible in the Bismarckian country as there is never a majority of native harmed with mobility. Only when the interest rate is sufficiently low, there is a welfare impact for some groups of agents and this impact is, in general, positive. The only exception occurs when the old outvote the young high-skilled and a pension system emerges in the country, harming the young high-skilled (which nevertheless do not form a majority). This implies that, in the Bismarckian country, not only there is never a majority harmed with mobility but, when R is sufficiently low, those that benefit from mobility outvote those that are harmed by it.

In the Beveridgean country, except for the cases where the interest rate is sufficiently large (and thus the voting equilibrium of the immobile labor setting with no pension system in both countries is sustained), there is always a welfare impact for the different groups of agents. For the cases where there is an inflow from the Bismarckian country, old agents are better-off while young agents see their welfare being reduced. But, as explained before, for mobility to have an impact on the pension systems and on welfare, it does not necessarily have to occur. Even for those cases where there are no incentives for labor to move, free labor mobility may have welfare consequences if it brings the tax rate in the Beveridgean country to zero. This is harmful for all agents except the young high-skilled (that nevertheless do not form a majority), which are better-off without the system.²¹

One can then conclude that, in the Beveridgean country, cross-country low-skilled labor mobility is harmful for a majority of the population if R is not sufficiently large, implying that there is an inflow of low-skilled to the country or that the existence of the system in the country is jeopardized, going from a positive tax rate to a zero tax rate. Under these conditions, labor mobility can only be politically feasible if appropriate compensatory measures are devised.

²¹ Recall that the change from $\tau = 1$ to $\tau = 0$ happens because the threat of an inflow of low-skilled from the Bismarckian to the Beveridgean in case of $\tau > 0$ makes the young low-skilled of the Beveridgean indifferent across all possible tax rates (as $\tau = 0$) with no mobility provides them the same utility as any other $\tau > 0$ with inflow mobility) and thus they have no incentive to cast a vote.

The Political Economy of Pension Systems with Low-Skilled Labor Mobility: A Cross-Country Analysis

Table 3: Welfare comparison, mobile labor

	Voting (closed \Rightarrow open)	Majorities	Mobility	Young high-skilled	Old low-skilled	Old high-skilled
$R < (1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}}$	$(0,1) \Rightarrow (1,1)$	$h < 0$	To B (corner)	$U^A > U^B$	$U^A < U^B$	$U^A > U^B$ for $a > \bar{a}$ $U^A < U^B$ for $a < \bar{a}$
$(1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}} < R < (1+n) \frac{a+\theta^a}{1+\theta^a}$	$(0,1) \Rightarrow (0,1)$	$h > 0$	To B (corner)	$U^A > U^B$	$U^A < U^B$	$U^A < U^B$
$R > (1+n) \frac{a+\theta^a}{1+\theta^a}$	$(0,1) \Rightarrow (0,0)$	$h < 0$	To B (interior)	$U^A > U^B$	$U^A < U^B$	$U^A < U^B$
	$(0,1) \Rightarrow (0,0)$	$h > 0$	None	$U^A = U^B$	$U^A = U^B$	$U^A = U^B$
	$(0,0) \Rightarrow (0,0)$		None	$U^A = U^B$	$U^A = U^B$	$U^A = U^B$

Note: $\hat{a} = \frac{3}{2} + \frac{1}{2} * \sqrt{9 + 80}^a$.

Table 4: Impact of mobility in the utility levels of the native of the Bismarckian and Beveridgean countries

	Voting (closed \Rightarrow open)	Majorities	Mobility	Bismarckian country		Beveridgean country		Bis. country	Bev. country
				Young	Old	Young	Old		
$R < (1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}}$	$(0,1) \Rightarrow (1,1)$	$h < 0$	To B (corner)	U^l	U^h	U^l	U^h	Majority harmed?	U^h
				$+$	$+$	$-$	$+$	NO	YES
$(1+n) \frac{a+\bar{\theta}}{1+\bar{\theta}} < R < (1+n) \frac{a+\theta^a}{1+\theta^a}$	$(0,1) \Rightarrow (0,1)$	$h > 0$	To B (corner)	$+$	$+$	$-$	$+$	NO	YES
				$=$	$=$	$-$	$+$	NO	YES
$R > (1+n) \frac{a+\theta^a}{1+\theta^a}$	$(0,1) \Rightarrow (0,0)$	$h < 0$	To B (interior)	$=$	$=$	$-$	$-$	NO	YES
				$=$	$=$	$-$	$-$	NO	YES
	$(0,0) \Rightarrow (0,0)$		None	$=$	$=$	$=$	$=$	NO	NO

Notes: =, +, and - denote, respectively, that the utility is the same with or without labor mobility; higher with labor mobility; and lower with labor mobility. o is the number of old voters; and h is the number of young high-skilled voters.

7. CONCLUDING REMARKS

We assess the consequences of decentralized asymmetric pension systems in a context of partial labor mobility. We show the conditions for a pension system to arise, as a function of the market returns and of inter- and intragenerational redistribution and, also, of the structure of the population (skill level and age). With non-myopic voters, the voting equilibrium may change with the possibility of mobility: in fact, the system may be created in the Bismarckian country, as the ageing of the population caused by the departure of the young mobile may create a majority in favor of pensions. Also, the pension system may be eliminated in the Beveridgean country, as the conditions for its existence become more stringent. In this case, it is interesting to note that mobility changes the voting equilibrium even though no migration actually occurs.

In the cases where at least one of the countries adopts a pension system, young low-skilled workers migrate to the most generous country (i.e. the country with higher income redistribution) but we do not necessarily have a corner solution, with all low-skilled young in the Beveridgean. This only happens if the potential gains from income redistribution are sufficiently high.

When the interest rate is sufficiently low, the Beveridgean (but not the Bismarckian) has a majority harmed by mobility. Thus, labor mobility can only be politically sustainable if appropriate compensatory measures are devised.

Some of our assumptions are important for the results achieved. We assume that the intergenerational redistribution is (contrary to the intragenerational redistribution) equal in both countries, since the autarchy dependency ratio is the same. Also, this autarchy dependency ratio is equal for low and high-skilled agents. The introduction of asymmetric natural growth rates across countries and across skill types would lead to more intricate incentives concerning voting and mobility decisions. Another important assumption concerns the production technology. The substitutability between both types of labor, low and high-skilled, has important welfare implications due to the positive relation between the wage levels. The type of mobility is also relevant to the results since, in our setting, only the agents that benefit from intragenerational redistribution are allowed to migrate. We could also explore the possibility of compensations across agents and/or countries.

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PANEL ANALYSIS OF THE FDI IMPACT ON INTERNATIONAL TRADE REVISITED

Manuela Magalhães
Ana Paula Africano

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ABSTRACT

This paper examines the relationship between Foreign Direct Investment (FDI) and international trade. Specifically, the relationship between the stock of outward FDI, and inward FDI and Imports and Exports in the Portuguese economy. This paper also studies some technical problems associated with panel data that have frequently been ignored in previous studies. And the problems of serial and contemporaneous correlation in particular can have a sizeable impact on estimates and statistical inferences. Our results show that there exist country-specific and time effects on the corrected panel data of heteroscedasticity and correlation and a substitutability relationship between imports and outward stock of FDI over the period 2000-2013.

Keywords: FDI; trade; gravity analysis; panel data.

JEL Classification: F1; F4.

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1. INTRODUCTION

In recent decades, international trade and foreign direct investment (FDI) have been the main engines of globalization. At the core of this process are the liberalization policies on trade and investment, on multilateral and bilateral/regional levels. Exports have grown much faster than GDP and FDI has grown at a faster pace than exports. This freer flow of goods, services and capital across-borders interconnect different economies, create interdependences and builds up economic integration. For policy making, it is important to have a good understanding of economic and social effects associate to trade and FDI, but also on their interactions.

The theoretical literature on trade and FDI is not conclusive on the existence of a substitution or a complementary relationship. References in the literature on trade models and in the literature on FDI demonstrate that, depending on the circumstances, FDI and trade may relate positively, as complements, as well as negatively, as substitutes. The empirical literature also indicates that FDI and trade may have a positive or negative relationship.

Over the last two decades, the Portuguese economy experienced strong shocks in international competitiveness. On the multilateral stage, competition increased substantially over two main events: the dismantling of the multi-fiber arrangement from 1995 to 2005 – under the Uruguay round – and the full admission of China into the WTO in 2001. On the European Union (EU) context, Portugal as a middle-low income economy experienced high competition pressure with the central and eastern European countries membership. These countries became competitors on both fields – in major Portuguese export markets and in attracting FDI from major investors. Additionally, as a founding member of the monetary union, the adoption of the common currency also intensified the competition within the Euro area.

Export indicators reveal an overall stagnant or deteriorating position: from 1995 to 2005, the ratio of exports of goods and services to GDP was stable at a value lower than 30%; export performance in terms of market share was declining in the first years of the millennium. Yet, since 2010, both indicators show a strong positive trend: by 2015 total exports were around 40% of GDP, with substantial gains in market share (OECD, 2017). Investment is crucial to sustain this recovery in exports, but since 2010 it has declined from 20.6% of GDP to 15.3% in 2015. Moreover, investment has been substantially weaker than that observed in other economies in the Euro area, and its current level is more than 30% smaller its pre-crisis value (OECD, 2017). In this context FDI has a critical role to consolidate international competitiveness of Portuguese economy.

In the aftermath of the crisis in Portugal it is recognized that economic growth must be driven by exports and investment rather than domestic consumption. In these circumstances, it seems relevant to revisit how FDI relates to trade in this economy.

Sections 2 and 3 present a brief review of, respectively, theoretical models and empirical studies that examine the relationship between FDI and Trade. Section 4 illustrates our modelling strategy of a modified gravity equation in a panel data framework of Portuguese trade and FDI. The main estimated results are presented and discussed in section 5. Section 6 concludes our study.

2. LITERATURE REVIEW

Traditionally, trade theories were developed in a framework that assumes international immobility of production factors. Yet, the activities of multinational enterprises have been growing since the Second World War and since the eighties multinational sales have been growing faster than trade in manufacturing. These growing flows and stocks of FDI could not be ignored by trade theories and as a result there was a stream of trade models that considered the existence of multinational enterprises along national enterprises. This was done within a variety of models that integrated the mode of foreign market access into the “new” trade theories. Overall, these models show that, depending on a variety of circumstances FDI and trade may have been complements as well as substitutes.

Foreign direct investment is the process by which a national firm has control/ownership over a business located in other country, normally identified as an affiliate. By this way the national firm becomes a multinational enterprise (MNE). There are two structurally different types of FDI, depending on the way the MNE organizes its international business, namely horizontally or vertically. Horizontal FDI is normally associated with bilateral flows of investments between developed economies. In this case the parent company reproduces the whole process of production of goods and/or services in different countries. Vertical FDI means that the home company fragments the production process across different locations/countries according to their respective comparative advantages generating intra-firm trade. By this way, the parent company rationalises its production and aims to reduce costs and to obtain gains in terms of efficiency. Vertical investments are mostly present in FDI flows from developed to less developed economies and normally refer to less sophisticated stages of the production process such as assembling operations. Vertical FDI may also take place between developed economies but in more sophisticated stages of the production process.

Complementarity between trade and FDI is normally found in trade models that incorporate vertical foreign investment, meaning that the MNE fragments/splits the production process across countries in order to reduce costs. In these types of models (e.g. Helpman, 1984, and Grossman and Helpman, 1991), differences in relative factor endowments between countries and differences in factor intensities and specialization between sectors are determinants of both trade and the formation of multinationals. They are particularly useful to explain FDI from developed countries into developing economies. Helpman (2006) considers that the development in trade theory that address within-industry heterogeneity in terms of size and productivity revealed that only small fraction of firms are able to take foreign business. Exporters are bigger and have higher productivity than non-exporters, and, in turn, firms with foreign investments are bigger and more productive than exporters. Within this context, international fragmentation of production has become more complex, and so have the sourcing strategies of firms as well as integration strategies of MNEs.

Markusen (1984) shows that complementarity between FDI and trade is still possible when countries have identical endowments, preferences and technology, and multinationalisation occurs in the context of multi-plant economies of scale. His basic idea

is the existence of firm/headquarter-specific activities which are distinct from plant-specific activities. Firm-specific activities are produced centrally at the headquarters, have a public good nature and generate firm-specific fixed costs. It includes activities such as R&D, distribution, administration services, marketing. Plant-specific activities are associated with the production process and generate plant-specific fixed costs. One possible solution for the model is a multinational monopoly, in which headquarter activities concentrate in the home country and the production plant goes to the host country, originating bilateral trade – headquarter services in exchange for final goods.

Substitution between FDI and trade is found in models that assume horizontal investments, meaning that the MNE produces the same goods and services in different countries. This is the most common type of FDI and refers to bilateral investments between developed economies. Some trade models assume similarity between countries – in size, endowments and technology – plus economies of scale at the firm and plant-levels incorporating an endogenous formation of multiplant multinationals. This is the case of models by Hortsman and Markusen (1992), Brainard (1993) and Markusen and Venables (1998) and they admit alternative solutions depending, on the one hand, on the relative size of the firm and plant scale economies, and, on the other, on trade costs – transport costs plus barriers to trade and investment. In other words, the equilibrium – exporting or investing – depends on the trade-off between proximity to the market which reduces trade costs and the concentration of production which allows for a better exploitation of economies of scale. High transport costs and plant-scale economies favour horizontal FDI that may be associated with distinct equilibria.

Markusen and Venables (1998, 2000), Egger and Pfaffermayer (2002) also explore another avenue – the convergence hypothesis – to demonstrate that FDI and trade are substitutes. Starting with the assumption of asymmetry between countries they show that the convergence in terms of size, endowments and income increases the activities of MNEs. As multinational enterprises displace national enterprises the volume of trade decreases, meaning that FDI substitutes trade. Finally, trade models by Markusen (1997, 2000) and Carr et al. (2001) admit both vertical and horizontal FDI and consequently find solutions that admit both complementarity as well as substitution between FDI and trade.

The international business literature typically looks at FDI and trade as alternative entry modes into foreign markets. Still, Dunning (1998) considers that the relation between trade and FDI may vary depending on the kind of trade and FDI analyzed and the conditions under which they occur, while Gray (1998) explicitly admits that production affiliates that are market seeking reduce trade whereas production affiliates that are efficiency seeking increase trade. In the former case, trade and FDI are substitutes and in the latter they are complements.

3. EMPIRICAL STUDIES

The particular question on whether FDI and trade are substitutes or complements has produced some empirical research without a definite result. Despite the strong

theoretical foundations for a substitute relation between FDI and trade this result has been found in few empirical studies (e.g. Frank and Freeman, 1978, Cushman, 1988, and Blonigen, 2001), while complementarity has been the most common result.

Most empirical research on this topic has looked for how changes in FDI correlate to changes in trade and vice versa. In other words, they have questioned whether systematic changes in FDI are related to systematic changes in trade, in particular if trade and FDI are substitutes (negative correlation) or complementary (positive correlation). These studies have not questioned or studied the direction of causality between FDI and trade and this seems to be a general limitation. As we will see below contrasting results are associated with the diversity of interactions that exist between FDI and trade, but also with different perspectives of analysis (e.g. country, industry, and firm).

At the country level, as suggested by Fontagné (1999), the links between trade and FDI can be seen from three different perspectives: the investing or home country, the recipient or host country and third countries. For the investing country FDI can be a substitute for trade to the extent that exports are replaced by local sales by the affiliates in foreign markets. On the other hand, FDI may also be complementary to trade to the extent that induces intra-firm trade in intermediate and final goods (e.g. headquarter services). In the former case investing abroad will have a negative impact on production, employment and trade balance in the home country, while in the latter case will have a positive impact. In the case of the host country the argument is symmetrical to that of the investor and therefore inward FDI may have a complementary or substitute relation with trade. Again the effects on domestic production, employment and the balance of trade (current account) can be diverse. Third economies may also affect, and be affected by, the relationship between FDI and trade, to the extent that foreign affiliates in these countries develop new trade relations with the affiliates in the host country and vice-versa.

At country level studies by Grubert and Mutti (1991), Blomstrom and Kokko (1994), Eaton and Tamura (1994), Brenton et al. (1999), Clausing (2000), and Hejazi and Safarian (2001) have found that FDI and trade are complementary. Several studies use the gravity model with success. For example, Grubert and Mutti (1991) examine how FDI relates to exports and imports for the United States, using trade flows with 33 countries in 1982. The study finds complementarity between FDI and both imports and exports on a bilateral basis. However, the authors suggest that a clear-cut conclusion needs a multilateral-country study. Clausing (2000) uses a panel data approach and studies the interaction between outward FDI and exports in the United States in her relation with 29 countries. He also studies the relationship between inward FDI into the US and American imports and uses gravity equations to find complementarity between trade and FDI. In another country study, Lafourcade and Paluzie (2011) study the impact of European integration on the geography of trade of French regions and FDI. They find that border regions with Spain and Italy experienced a decline in trade with neighboring countries, in contrast with all other border regions. The authors point the decline in the propensity of Spanish and Italian affiliates in these regions to trade with the respective home country, suggesting a substitution effect between FDI and trade.

Martinez et al. (2012) use a multilateral approach to study the impact of EU market integration (i.e. the reduction of trade barriers among EU members) on flows of trade and FDI. Using a gravity equation their results suggest that FDI and trade are complements as they reinforce each other. This effect is valid for intra-EU FDI, but also for FDI originated in third countries. They also point that access to market share is more relevant than access to costs-differentials suggesting that horizontal FDI prevail over vertical FDI.

Micro (firm)-level studies allow for a better understanding on the complex interlinks between trade and FDI. However, this approach requires detailed data bases about firm's decisions on production, sales and investment which are not extensively available. Baldwin and Okudo (2013) develop a study based on detailed information about Japanese affiliates around the world. They find clear evidence that Japanese multinationals have mixed motivations for FDI and their affiliates are partly vertical and partly horizontal. This pattern is observed across sectors and countries. They found that whereas affiliates in North America were more horizontal, in Europe and Asia they were more vertical. In the latter case networked FDI prevail as firms are seen as part of a regional production network. They also found that overall from 1996 to 2005 affiliates became more vertical across sectors and countries. Within the multiple combinations that affiliates follow on sourcing for intermediates and output sales there is scope for both complement and substitution effects between trade and FDI.

4. THE ECONOMETRIC MODEL

Our objective is to estimate the relationship between trade and FDI in the Portuguese economy. The empirical analysis applies a modified gravity equation to a panel of annual observations of Portuguese exports to and imports from 27 countries over a period of 14 years (2000-2013). Two different equations are estimated one for exports and the other for imports.

The gravity equation estimated is the following:

$$T_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 DIST_i + \beta_3 Lang_i + \beta_4 Bord_i + \beta_5 TFDIn_{it} + \beta_6 TFDIout_{it} + u_i + \theta_t + v_{it} \quad (1)$$

for $i = 1, \dots, N$; $t = 1, \dots, T$, where T_i indicates the imports/exports between Portugal and country i , GDP_i denotes the corresponding Gross Domestic Product. $DIST_i$ is the great circle distance between capital of country i and capital of Portugal (Lisbon). $Lang_i$ and $Bord_i$ are dummy variables and take the value one when the country i has the same language or has a common border with Portugal. $TFDIn_i$ and $TFDIout_i$ are the transformed variables of the FDI stock of country i in Portugal ($TFDIn$) and the FDI stock of Portugal in country i ($TFDIout$).

In our specification, we apply a two-way model that incorporates a time-specific effect (θ) and a country-specific effect (u). v_{it} is the idiosyncratic error.

All variables except dummy variables are in logs. As the model is log-linearised the problem appears with zero or negative values. To avoid this problem we transform the FDI stock variable.¹ This study uses the stock of FDI as an explanatory variable of trade flows which has several advantages in relation to the alternative inclusion of FDI. First, the stock variable avoids problems of multicollinearity between trade and investment flows, given that such flows are simultaneously affected by the same economic variables. Second, this approach is more correct because FDI flows do have an impact on trade with a time lag. Therefore, the use stocks is able to capture these lagged effects which is not possible with flows. Third, the stock of FDI gives a more accurate measure of foreign investment in the economy and as such the extent to which it facilitates or obstructs trade flows.

Since individual effects are included in the model, we have to decide whether they are treated as fixed or random. If u_i is treated as a random variable we have the called random effect model. In this case $u_i \sim iid(0, \sigma_u^2)$, $v_{it} \sim iid(0, \sigma_v^2)$ and u_i are independent of v_{it} .

In addition, the explanatory variables are independent of u_i and v_{it} for all i and t (Baltagi, 1995). Otherwise, if u_i are assumed to be fixed parameters to be estimated and the remaining disturbances stochastic with v_{it} independent and identically distributed $iid(0, \sigma_v^2)$, then the explanatory variables are assumed independent of v_{it} for all i and t .

In this case, FEM is applied.²

We estimate a two-way FEM and a two-way REM, where all variables, except dummy variables, are in logarithms. After, we determine Hausman's χ^2 statistic for testing random versus fixed effects. Whether the REM or the FEM is the econometrically more appropriate depends on the correlation of the individual effects with the regressors. REM assumes that there is no such correlation.

The application of OLS to data characterised by nonspherical errors produces inefficient coefficient estimates and the corresponding errors estimates are biased. The application of GLS produces coefficient and standard errors estimates that are efficient

¹ The larger desinvestment in our sample is - 83000. So, we divided all observation of FDI stock by 83000 (ratio: $fdi/83000$). Therefore, all values of transformed FDI stock are greater than -1. After we add one to the ratio and log-linearised it:

$$TFDIin_{it} = \ln(1 + TFDIin_{it}/83000),$$

$$TFDIout_{it} = \ln(1 + TFDIout_{it}/83000).$$

This transformation of FDI stock does not change its values. If:

$$FDI < 0 \Rightarrow (1 + \frac{FDI}{8300}) < 1 \Rightarrow \ln(1 + TFDIin_{it}/83000) < 0;$$

$$FDI = 0 \Rightarrow (1 + \frac{FDI}{8300}) = 1 \Rightarrow \ln(1 + TFDIin_{it}/83000) < 0; \text{ and}$$

$$FDI > 0 \Rightarrow (1 + \frac{FDI}{8300}) > 1 \Rightarrow \ln(1 + TFDIin_{it}/83000) < 0.$$

² The FEM does not allow directly to estimate time-invariant variables.

and unbiased, respectively, assuming that the errors covariance structure is correctly specified and its elements known.

Becky and Katz (1995) have studied an error covariance structure characterised by groupwise heteroscedasticity, first-order serial correlation and cross-sectional, or spatial correlation and they have used the Monte Carlo analysis to compare FGLS with OLS, where OLS standard errors are corrected for the three categories of nonspherical disturbances. They have called their estimator OLS with panel corrected standard errors (PCSE). Their study shows that FGLS consistently underestimates standard errors, concluding that OLS with PCSE is superior to FGLS, and recommend its use.

5. RESULTS

In this section the estimation procedures follow two sequential stages. First, we start with a robust pooled data estimation (ROLS), a fixed effects model (FEM) and a random effects model (REM) estimation. Given the nature of panel data, we test the hypothesis of groupwise heteroscedasticity and correlation (serial or contemporaneous) in both. As the null hypothesis is rejected, in the second stage we correct the panel for heteroscedasticity and correlation. This is done with PCSE and feasible GLS and in order to deal with unobservable fixed effects, the first differences are estimated by PCSE, FGLS and robust OLS. This procedure is followed separately for exports and imports.

5.1. EXPORTS

The OLS³ estimation does not take into account that the error structure may not conform to OLS assumptions, and to overcome this we use the White estimator of variance (Table 1, first column). The OLS model explains a large part of the variance of Portuguese exports ($R^2=0.84$). All variables, except language and border are statistically significant. These results suggest that Portuguese exports to Spain and Brazil are not encouraged or discouraged by their common border or language, respectively. In relation to Spain, it is worth mentioning that Portugal has a shorter period of market integration with Spain – only since 1986 when both become EU members. In contrast, with other EU economies strong trade relations exist since the earlier 1960s when Portugal become an EFTA member. As for the FDI-trade hypothesis, the result suggests a strong complementary relation between FDI and Portuguese exports.

However, as mention above, the OLS model does not take into account individual effects and we believe in the existence of individual effects apart from distance, language and border. Thus, we have done the Breusch and Pagan test ($LM_{BP} = 753.55$) that has confirmed our suspicion. Next, we have estimated the model using fixed-

³ The missing values of the inward and outward FDI were removed and we have used a transformed variable of FDI to avoid problems with the logarithm of null and negative values.

-effects⁴ and random-effects, but the Hausman test reveals that REM does not obtain consistent parameter estimates suggesting the existence of individual fixed effects.

Despite the conclusion on the existence of fixed effects, all variables in the FEM, except the variable GDP, are statistically insignificant. This fact can be associated with the violation of the homocedasticity hypothesis across countries. Therefore, we have tested for groupwise likelihood ratio heteroscedasticity in fixed effect model and the result was that the null hypothesis of homocedasticity across countries is rejected ($GW: \chi^2(23) = 9,819.97$). This limitation can be overcome with the adoption of a feasible GLS estimator or a PCSE with a general variance matrix that incorporates heteroscedasticity across countries.

Finally, we have tested for serial correlation and contemporaneous correlation in our fixed effect model and have found evidence of autocorrelation. For the FEM presented in column (3) of Table 1 we reject the null hypothesis of no first-order autocorrelation ($F(1, 23) = 104.298$) generated by AR process and we conclude that there exists contemporaneous correlation.

Given the results of the heteroscedasticity and autocorrelation tests, we have decided to apply the feasible GLS (FGLS) and PCSE estimator, corrected of country groupwise heteroscedasticity and contemporaneous correlation.

The FGLS is a method developed by Parks-Kmenta that uses GLS estimation and we have corrected it for first serial correlation in the residuals, contemporaneous correlation and heteroscedasticity. The PCSE method was developed by Beck-Katz and incorporates also these corrections. However, we need one process that takes into account individual effects, heteroscedasticity and correlation and that produces consistent estimates. One way to do this is by differentiating the equation 1 which allows the removal of fixed effect and eliminates the autocorrelation. Therefore, we estimated the first difference model by PCSE and FGLS controlling heteroscedasticity and contemporaneous correlation and by OLS with a robust variance-covariance matrix.

The results reported in columns 4, 5 and 6 in Table 1 point to the conclusion that Portuguese exports are positively determined by market dimension. The presence of foreign affiliates in the Portuguese economy has no statistically significant effect on the Portuguese exports during the period 2000-2013. In other words the stock of inward/outward FDI does not seem to be trade creating. This result suggests that the stock of foreign investments in the Portuguese economy does not work as a channel through which exports expand. Thus, for the period 2000-2013 we did not find the complementarity relationship between FDI and Exports as it was found by Africano and Magalhães (2005) and Magalhães and Africano (2007) for the period 1995-2000. One explanation is the different period of analysis, where now the significance of inward FDI is replaced by the significant positive time effects which may reflect the effect of higher integration of the Portuguese economy in the EU and the small size of the Portuguese economy being the Portuguese exports only determined by the dimension of the other countries' GDP and time effects. Another explanation may be a change in the composition of the inward FDI. If the inward FDI is now directed to finance services there is no reason to

⁴ The FEM incorporates both country and time effects.

Table 1: Estimation results for Exports

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	ROLS	FEM	REM	FD-PCSE	FD-ROLS	FD-FGLS
GDP	0.860 ^{***}	1.034 ^{***}	0.955 ^{***}	1.758 ^{***}	1.758 ^{***}	1.758 ^{***}
	(28.65)	(3.47)	(9.66)	(3.24)	(4.13)	(5.14)
Dist	-0.000319 ^{***}		-0.000337 ^{***}			
	(-16.64)		(-5.43)			
Lang	-0.229		-0.0829			
	(-1.23)		(-0.12)			
Bord	0.122		1.305 [*]			
	(0.73)		(1.82)			
TFDlin	6.607 ^{***}	0.314	0.769	0.744	0.744	0.744
	(5.55)	(0.42)	(1.02)	(0.92)	(1.06)	(0.72)
TFDout	0.106 ^{**}	-0.00545	0.00604	0.00226	0.00226	0.00226
	(2.53)	(-0.22)	(0.24)	(0.26)	(0.24)	(0.14)
Constant	2.288 ^{***}	-1.053	1.128	0.0166	0.0166	0.0166
	(6.16)	(-0.27)	(0.91)	(0.36)	(0.86)	(0.93)
R^2	0.84			0.13	0.13	
Obs.	252	252	252	183	183	183
Hausman: $\chi^2(13)$			9.87 ^{**}			
F(3, 216)		14.07 ^{***}				
Wald $\chi^2(k-1)$			613.14 ^{***}	12.71 ^{***}		1340.88 ^{***}
GW $\chi^2(i)$		9819.97 ^{***}				
F(1, 22)		104.298 ^{***}				
$LM_{BP}: \chi^2(1)$			753.55 ^{***}			

Notes: ***, **, and * denotes significance at the 1%, 5%, and 10%, respectively. Standard deviation in brackets.

increase exports. The Portuguese investments abroad also have a statistically insignificant effect on the Portuguese exports as in the previous studies (Africano and Magalhães, 2005, and Magalhães and Africano, 2007).

5.2. IMPORTS

Table 2 presents the results of the robust OLS, fixed effects and random effects estimator. Here the missing values of inward and outward FDI were also dropped and the OLS estimates were obtained using the White estimator of variance. The OLS model explains a large part of the variance of Portuguese imports ($R^2 = 0.74$) that is determined by market dimension (0.635), distance (-0.000241), language (0.46), border (0.741), inward FDI (6.176) and outward FDI (0.117). The inward and outward FDI stock have a positive and significant effect on Portuguese imports which places emphasis on the relationship of complementarity between imports and inward FDI when we are taking pool data into account. Portugal imports above “normal” from Spain and Brazil, given that language and border variables are statistically significant.

We have followed the same procedure as in the previous section for exports and we test for the existence of individual heterogeneity, and the existence of heteroscedasticity and autocorrelation, and contemporaneous correlation in our model of imports. The groupwise likelihood test shows that the disturbances ($GW = 3198.67$) are heteroscedastic. Additionally, they are also serially correlated ($F(1, 22) = 11.337$) and contemporaneous correlated, invalidating the statistic inference.

So, in order to have consistent estimates and consider the existence fixed effects they were removed by differentiating the model with the first differences model, which amounts to build model (1) in the variables first differenced. Thus, we estimate first difference with pooled robust OLS, PCSE and FGLS.

Columns 4, 5 and 6 in Table 2 show that Portuguese imports are positively determined by market dimension and negatively determined by the stock of outward FDI. The stock of foreign investments abroad has a negative and statistically significant correlation with Portuguese imports. This result suggests that there is a substitutability relation between the stock of outward FDI and Portuguese imports. Thus, for the period 2000-2013 Portuguese affiliates in the exterior act as a substitute channel for imports reducing the Portuguese imports. This substitute relationship is found for Austria, Brazil, Canada, Czech Republic, Finland, Greece, Iceland, Japan, Mexico, Norway and USA. Yet inward FDI is not statistically significant which reveals that foreign affiliates in Portugal have no impact on Portuguese imports.

6. CONCLUSION

This paper examines the relation between FDI stock (inward and outward) and Portuguese trade flows. In this paper we have applied a panel data analysis, to Portuguese trade flows with 23 trade partners over the 2000-2013 interval. The gravity model was

Table 2: Estimation results for Imports

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	ROLS	FEM	REM	FD-PCSE	FD-ROLS	FD-FGLS
GDP	0.635 ^{***}	0.443	0.681 ^{***}	2.119 ^{***}	2.119 ^{***}	2.119 ^{***}
	(17.14)	(1.43)	(5.76)	(3.97)	(4.33)	(4.83)
Dist	-0.000241 ^{***}		-0.000250 ^{***}			
	(-9.92)		(-3.31)			
Lang	0.460 ^{**}		0.682			
	(2.13)		(0.79)			
Bord	0.741 ^{***}		1.912 ^{**}			
	(3.57)		(2.19)			
TFDIin	6.176 ^{***}	0.780	1.089	0.937	0.937	0.937
	(4.08)	(1.00)	(1.40)	(0.51)	(0.46)	(0.71)
TFDIout	0.117 ^{**}	-0.00407	0.00337	-0.0464 ^{***}	-0.0464 ^{***}	-0.0464 ^{**}
	(2.32)	(-0.16)	(0.13)	(-3.26)	(-3.21)	(-2.25)
Constant	5.465 ^{***}	7.300 [*]	4.913 ^{***}	0.00327	0.00327	0.00327
	(12.01)	(1.78)	(3.30)	(0.08)	(0.14)	(0.14)
R^2	0.74	0.40		0.13	0.13	
Obs.	252	252	252	183	183	183
Hausman: $\chi^2(13)$			49.03 ^{***}			
F(3, 216)		1.03				
Wald $\chi^2(k-1)$			197.79 ^{***}	31.39 ^{***}		3510.83 ^{***}
GW $\chi^2(i)$		3198.67 ^{***}				
F(1, 22)		11.337 ^{***}				
$LM_{BP}: \chi^2(1)$			753.55 ^{***}			

Note: See notes to Table 1.

used to test the hypothesis of complementarity or substitutability on a panel analysis. Besides examining the type of relationship between FDI and trade flows, we also investigated the error structure and applied consistent estimation methods that take into account fixed effects associated to unobserved country effects.

We find a substitute relationship between outward FDI and imports when the residuals are corrected and PCSE, FGLS and robust OLS estimation method are applied to first differences. For the period under analysis, inward stock of FDI has no significant effect on trade. This suggests that foreign investments in the Portuguese economy have a neutral impact on trade balance. Yet, Portuguese affiliates act as a substitute of imports which favours the Portuguese trade balance. Nevertheless, studies at a lower level of aggregation should be carried out to better understand the effects of FDI on trade at sector level. At lower level of aggregation, positive balance effects in some sectors may cancel out negative balance of trade in other sectors leading, at aggregate level, at no significance of inward FDI on trade.

Portuguese investments abroad, as shown in both regressions, have no impact on exports which to some extent is not surprising. Such investments are relatively small in value and highly concentrated in just two markets: Spain and Brazil. Moreover, in the latter case investments were primarily directed to the privatisation of non-tradable services. Regarding outward FDI, although we have not found the substitute relationship between outward FDI and Exports when we correct for serial and contemporaneous correlation as in Fonseca et. al. (2010), we found a substitute relationship between outward FDI and imports which is particular relevant for countries such Japan, Greece, Finland, and Austria.

The policy implications of these results are not totally clear. On the one hand, policies designed to help the internationalization of Portuguese companies' through FDI did not improve the external competitiveness of the Portuguese economy as measured by exports. On the other hand, our results suggest these policies may at least contribute to diminish the weight of imports on trade balance.

This question may be clarified by studying the effects of FDI on trade at sectorial level that would provide greater insights into this relationship. Moreover, a sample with a longer time period might be a condition to capture the impact that changes in external trade conditions have on Portuguese trade. These could be changes in the EU external trade policy on a bilateral level or at multilateral level in the WTO.

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APPENDIX: DATA SOURCES

In order to test the relationship between trade and FDI in the Portuguese economy we use a sample of OECD countries and Brazil, observed from 2000 to 2013. Values of Portuguese bilateral trade were taken from the OECD Statistical directory in current USD. These values were converted into the 1000 base year prices through the consumer price index from the International Financial Statistics. Only the trade in goods is included, meaning that trade in services is not taken into account in this study.

GDP values were obtained from the GDP per capita and population values from the Penn world table (PWT 9.0). The GDP in purchase power parity of 2000, and values for the other years were calculated with the Chain index. Inward and outward FDI are from the OECD International Direct Investment Database, in millions of Escudos, and then converted to USD with the yearly average exchange rate from the International Monetary Fund, International Financial Statistics CD-ROM. The variable distance is measured in kilometers and refers to the great circle distance between Lisbon and each capital of the countries included in the sample.

O MERCADO DE CRÉDITO ESPECIALIZADO AO CONSUMO EM PORTUGAL

Teresa Garcia
Paulo Vieira

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RESUMO

O artigo analisa o mercado de crédito ao consumo em Portugal no período 1998-2011. A análise econométrica considera diversos modelos de regressão linear para identificar e avaliar o impacto das variáveis que o determinam, assente na teoria do ciclo de vida do consumo, na economia do crédito ao consumo e na teoria das finanças pessoais. Os resultados da estimação dos modelos permitiram concluir que as variações trimestrais do crédito concedido num dado trimestre são fortemente influenciadas pela variação do trimestre imediatamente anterior, bem como pelo fator sazonal presente no quarto trimestre de cada ano do período em análise. Adicionalmente, as importações desempenham um papel determinante na evolução da concessão deste tipo de crédito.

ABSTRACT

This paper analyses the consumer credit market in Portugal for the period from 1998 to 2011. The econometric analysis considers several linear regression models that are used to identify and evaluate the impact of independent variables on consumer credit, based on the life-cycle theory of consumption, the economics of consumer credit, and the theory of household and personal finance. The findings indicate that quarterly variations of consumer credit are significantly influenced by the credit variation of the previous quarter, and, additionally just during the fourth quarter, also by the seasonal factor, for every year under analysis. Furthermore, imports also make a relevant contribution to the evolution of the consumer credit market.

Keywords: Consuming credit; Portugal; descriptive data analysis, linear regression models.

JEL Classification: D12, D14

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1. INTRODUÇÃO

A liberalização do crédito, em geral, e do crédito ao consumo, em particular, que teve início no final do século xx, em Portugal, conduziu ao seu crescimento significativo. Torna-se assim premente analisar a evolução do crédito ao consumo para o período de 1998 a 2011. De facto, em 1998 regista-se a terceira fase da UEM e em 2011 tem lugar uma ajuda externa a Portugal protagonizada pelo FMI, a Comissão Europeia e o BCE (BIS, 2011), o que justifica o período escolhido.

Em Portugal, o tema não tem sido objecto de estudo, embora as preocupações com o sobreendividamento e com a formação financeira tenham conduzido ao Relatório do Inquérito à Literacia Financeira da População Portuguesa (BdP, 2011) e ao Plano Nacional de Formação Financeira (PNFF), lançado em 2011 pelo Conselho Nacional de Supervisores Financeiros (CNSF), visando contribuir para elevar o nível de conhecimentos financeiros da população e promover a adoção de atitudes e comportamentos financeiros adequados (BdP, CMVM, e ISP, 2012; BdP, CMVM, e ASF, 2016). Consequentemente, este artigo tem como objectivo colmatar essa lacuna, quer através de uma análise descritiva do mercado de crédito ao consumo quer através de uma análise econométrica que ponha em evidência os factores que determinam a sua evolução.

O crédito ao consumo enquadra-se na temática do consumo que visa perceber o que motiva os indivíduos a consumir e de que forma estes se encontram restringidos ou influenciados por certos factores, como o rendimento disponível ou a idade (Bertola et al. 2006). Em termos agregados, revê-se o conceito de função consumo e as teorias explicativas do consumo para fundamentar as variáveis explicativas do crédito ao consumo que serão testadas num modelo de regressão linear.

Este trabalho encontra-se dividido em seis secções. Na segunda, é elaborada uma revisão de literatura sobre o consumo e sobre o crédito ao consumo. Na secção 3 apresenta-se a associação representativa das instituições vocacionadas para o financiamento especializado ao consumo em Portugal (ASFAC) e é feita uma breve análise descritiva da série de dados relativos à concessão de crédito ao consumo entre 1998 e 2011. A secção 4 é constituída pelas hipóteses a testar e pelo modelo utilizado. Os resultados são analisados na secção 5. Por último, na secção 6, são apresentadas as principais conclusões.

2. REVISÃO DE LITERATURA

A análise do consumo e das decisões de consumo tem evoluído ao longo do tempo, pondo em destaque variáveis com o rendimento disponível, a idade, a dimensão da família, a riqueza, a educação e o acesso ao crédito. Já a temática do crédito ao consumo tem sido pouco estudada.

No início da década de 1950, o modelo prevalecente da função consumo inspirou-se na lei psicológica fundamental do economista John Maynard Keynes, segundo a qual quando o rendimento disponível aumenta, o consumo aumenta numa menor proporção (Attanasio e Weber, 2010).

Devido a algumas inconsistências a nível empírico, foram desenvolvidos, na mesma década, o modelo do ciclo de vida por Modigliani e Brumberg (1954) e o modelo do

rendimento permanente por Friedman (1957). A hipótese do ciclo de vida estabelece que a principal razão para se poupar é a necessidade de precaver o futuro em termos de rendimento, nomeadamente quando se atinge uma idade avançada (Modigliani, 1988; Deaton, 2005). Não obstante, Banks et al. (1998) referem que a diferença entre a descida no consumo expectável e a descida no consumo real resulta de choques inesperados, nomeadamente ao nível da informação disponível perto da idade da reforma, em oposição a uma falta de racionalidade no padrão de consumo ao longo do ciclo de vida (Dilnot et al., 1994).

A teoria do rendimento permanente assenta no pressuposto de que os indivíduos procuram manter o seu nível de consumo estável, evitando que este oscile como resultado de variações do rendimento disponível a curto prazo (Meghir, 2004). Assim, os indivíduos estabelecem o seu consumo com base numa perspectiva de rendimento de longo prazo, ou seja, de rendimento permanente, que se obtém como uma média do rendimento recebido pelo indivíduo ao longo da sua vida.

O aspecto mais relevante de ambos os modelos é o de tratar as decisões de consumo como parte de um problema de alocação intertemporal, sendo o horizonte temporal a principal diferença entre eles nas suas formulações originais. Finito no primeiro e infinito no segundo (Attanasio, 1999; Browning e Crossley, 2001).

Bertola et al. (2006) consideram que as famílias adoptam o seu nível de consumo óptimo em cada período sujeito a uma restrição orçamental intertemporal, de forma a controlar a sua volatilidade. Assim, a poupança, como refere Courdet (1990), responde somente a dois motivos: o reembolso de dívidas realizadas no início da vida activa, e a constituição de um capital que permita financiar a reforma. Deste modo, grande parte da riqueza é gerada pela acumulação para ser consumida no fim da vida e não por via das transferências intergeracionais. Masson (1991) refere que a hipótese do ciclo de vida, mais do que tudo o resto, fundamenta um determinado esquema de escolhas ou de decisões patrimoniais dito de “procedimento hierarquizado” com três etapas fundamentais. Em primeiro lugar, a família, cujos rendimentos e necessidades (dimensão, etc.) são por hipótese previamente fixados, efectua a arbitragem intertemporal entre consumo e poupança de acordo com o perfil de acumulação óptimo sobre o horizonte da sua existência. Numa segunda fase, procede à decisão relativa à combinação de classes de activos a deter, dada a poupança segundo a idade. Por último, na terceira etapa, faz as escolhas de investimento em cada activo que, no seio da restrição global imposta pelas escolhas de poupança, respondem melhor às suas necessidades.

O mais relevante deste esquema é que vem ao encontro das preocupações actuais que se manifestam com o surgimento do “conselho patrimonial global” (por contrapartida da gestão corrente da carteira) e com o crescendo de produtos de poupança de longo prazo, assentes na preparação da reforma, mas também dos produtos de crédito ao consumo.

A hipótese do ciclo de vida conduz a diversas possibilidades de análise quando diferentes tipos de comportamento são admitidos para os perfis do rendimento e, por conseguinte, do património. A evidência empírica mostra que os comportamentos patrimoniais se explicam, para uma parte não negligenciável de indivíduos e famílias, pela existência de restrições de liquidez que limitam fortemente as possibilidades de um património

líquido negativo. As consequências dessas restrições de liquidez, quando aliadas à incerteza quanto ao futuro, são precisamente as ocorrências de heranças “acidentais” e de heranças “voluntárias”. Em oposição, a inexistência de restrições de liquidez, através do acesso ao crédito ao consumo sem limite, pode conduzir a endividamento e a património líquido negativo. Esta possibilidade mostra os perigos potenciais associados a um desenvolvimento não controlado do crédito ao consumo e ao sobreendividamento, como acontece já em alguns países (EC, 2008). Por outro lado, poderá justificar a tendência decrescente das taxas de poupança dos particulares em muitos países, incluindo Portugal (Rocher e Stierle, 2015; Garcia, 2013; Costa e Farinha, 2012), com consequências no financiamento das respetivas economias.

Torna-se assim pertinente analisar os factores que determinam o crédito ao consumo. Bertola et al. (2006) afirmam que a concessão de crédito ao consumo enfrenta os mesmos problemas que o crédito empresarial, ao ser afectada pelo risco moral e por problemas de selecção adversa decorrentes da assimetria de informação. A taxa de juro praticada deverá ser tão reduzida quanto possível, de forma a ser atractiva para consumidores com capacidade de cumprimento, bem como para controlar o risco de contraparte dos restantes consumidores. Campbell (2006) refere que algumas famílias cometem sérios erros nas decisões de investimento, devido ao facto do conjunto de produtos financeiros disponível ser confuso e de um elevado grau de complexidade. Neste contexto, a expansão da educação financeira junto das famílias, embora relevante, poderá não ser tão eficaz como a regulamentação do consumo de forma a solucionar os problemas/custos que advêm das más decisões de investimento. A probabilidade das famílias declararem insolvência aumenta com o benefício económico que daí advém (Fay et al., 2002). Alguns estudos, baseados em inquéritos, concluem que os principais factores que levam as famílias a declarar insolvência são problemas de saúde, de desemprego e de divórcio (Sullivan et al., 2000; Himmelstein et al., 2009). O fenómeno das insolvências pode também ser uma consequência das políticas de concessão de crédito. Dick e Lehnert (2010) apontam a liberalização do sector bancário, que teve início na década de 80, o grau de abertura ao exterior, e as alterações tecnológicas na concessão de crédito aos consumidores, como causas significativas da expansão do crédito ao consumo e do aumento exponencial de consumidores a declararem insolvência.

Em Portugal, não existem estudos que analisem os factores que determinam o crédito ao consumo. Não obstante, Santos et al. (2013) oferecem uma revisão crítica de literatura sobre o consumo e o crédito às famílias que procura identificar os principais contributos e desvantagens das abordagens disciplinares para a compreensão dos múltiplos factores que os influenciam.

O presente artigo pretende pôr em evidência os determinantes do crédito total ao consumo, em termos agregados, utilizando um modelo linear em que as variáveis explicativas escolhidas se baseiam na revisão de literatura mais relevante atrás exposta mas também na análise histórica da variável dependente, mediante um conjunto de cinco hipóteses. Assim, são consideradas como variáveis explicativas o grau de abertura ao exterior, a procura interna, as vendas de automóveis ligeiros de passageiros, as importações, as exportações, e o produto interno bruto.

3. ENQUADRAMENTO DA ASFAC E DO CRÉDITO

A ASFAC (Associação de Instituições de Crédito Especializado)¹ data do ano de 1991 e é a organização representativa do sector do financiamento especializado ao consumo em Portugal.² Dos vários objectivos a que a ASFAC se propõe, destacam-se a defesa e representação dos interesses do sector do crédito especializado perante as entidades de tutela³, a representação do sector junto de entidades públicas⁴ e privadas⁵ e ainda a criação e promoção de informação relacionada com o mercado do sector de crédito especializado que possa ser útil para várias entidades do foro público ou privado, e a nível nacional e internacional. Internacionalmente, a ASFAC representa as entidades que a compõe junto da EUROFINAS (European Federation of Finance House Associations)⁶.

É possível analisar o setor através dos dados trimestrais sobre concessão de crédito, fornecidos pela ASFAC, para o período 1998-2011 (Figura 1). Os valores trimestrais médios situam-se próximos dos 1.100 milhões de euros. O primeiro e o quarto trimestre são geralmente os trimestres em que se concede respectivamente o menor e o maior montante de crédito.

O crédito concedido é repartido em quatro tipos principais, Crédito Clássico, Crédito Fornecedores (stock), Crédito *Revolving* e ainda Outros.⁷ A tendência é globalmente crescente até à Grande Recessão de 2008, data a partir da qual se regista uma maior volatilidade (Figura 2).

¹ Esta entidade tinha como designação Associação de Sociedades Financeiras para Aquisições a Crédito até ao ano 2005. Consultar www.asfac.pt.

² Actualmente é composta por 30 membros, dos quais 26 instituições de crédito especializadas no financiamento ao consumo e as restantes prestadoras de serviços essenciais ao funcionamento das anteriores.

³ Nomeadamente o Ministério das Finanças e o Banco de Portugal.

⁴ Nomeadamente a Direcção Geral do Consumidor e o Instituto Nacional de Estatística (INE).

⁵ Nomeadamente a Associação Portuguesa de Bancos (APB) e a Associação de Comércio Automóvel de Portugal (ACAP).

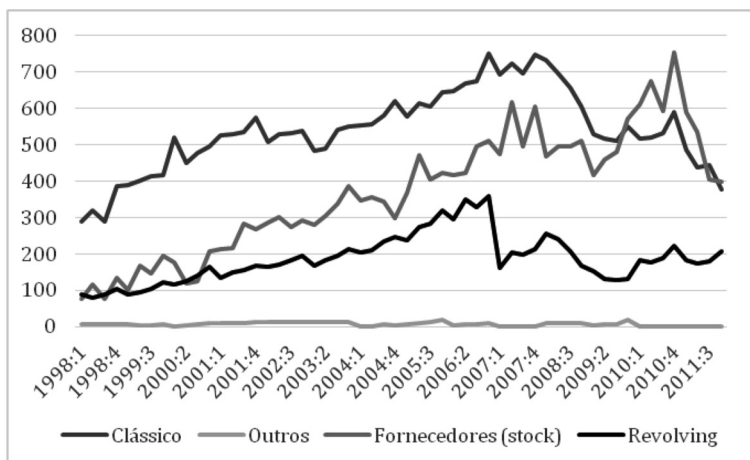
⁶ A EUROFINAS foi criada em 1959 pelas associações da Áustria, Bélgica, França, Alemanha, Reino Unido, Holanda e Suécia, onde o mercado de crédito especializado já se encontrava bastante desenvolvido.

⁷ De acordo com a ASFAC, o Crédito Clássico consiste no financiamento da aquisição de bens ou serviços para o consumidor final cuja liquidação tem um plano de amortização pré-definido. Este tipo de crédito é habitualmente concedido a particulares, empresários em nome individual e empresas e é usado para financiar a aquisição de meios de transporte, equipamentos para o lar ou outro tipo de equipamentos, em concreto autocaravanas, barcos e roulottes. O Crédito Fornecedores (stock) visa permitir a aquisição de bens para posterior revenda, independentemente do sector de actividade retalhista. O Crédito *Revolving* não está intrinsecamente ligado à aquisição de um bem ou serviço, tal como acontece com o crédito pessoal. Porém, o ponto em que diferem estes dois tipos de crédito é o facto do crédito *revolving* não ter um prazo fixo para a amortização de dívida. Este assenta num plano de amortização de dívida flexível e num *plafond* de crédito. Os exemplos mais comuns do crédito *revolving* são a abertura de crédito em conta corrente e os cartões de crédito. Por último, o Crédito Outros inclui tipos de crédito que não estão definidos nos anteriores.

Figura 1: Crédito total ao consumo em Portugal, 1998:1-2011:4 (em milhões de Euros)



Figura 2: Crédito ao consumo por tipo em Portugal, 1998:1-2011:4 (em milhões de Euros)



Constata-se que a rubrica Outros não é relevante, o Crédito Clássico representa quase metade do crédito total, seguindo-se o Crédito Fornecedores e o Crédito *Revolving*. O Crédito Clássico representou em média um volume de cerca de 540 milhões de euros por trimestre e de 2.160 milhões de euros anuais. Este tipo de crédito subdivide-se consoante o tipo de

cliente, particulares e empresas, e o tipo de produto financiado. O crédito destinado a particulares representa cerca de 90,87% do Crédito Clássico, estando os restantes 9,13% destinados às empresas.

O Crédito Fornecedores tem-se afirmado como a segunda maior rubrica do crédito total, revelando que as empresas têm vindo continuamente a recorrer a este tipo de crédito como forma de financiamento. Os dois anos em que se registaram os maiores montantes concedidos, 2007 com um valor de 2.193 milhões de euros e 2010 com um valor de 2.633 milhões de euros, foram também os anos após os quais se registaram as maiores variações negativas, respectivamente 10,08% e 26,67%, contribuindo assim para um período de instabilidade.

Por último, o Crédito *Revolving* representou 16,94% do crédito total concedido, com um valor médio de 746 milhões de euros anuais. Em 2006 foi concedido o maior montante de crédito *revolving* registado no período, num valor de 1.335 milhões de euros, seguindo-se de uma quebra de 41,73% no ano de 2007.

Foram celebrados, em média, 508.441 contratos de Crédito Clássico por ano para o período em análise, dos quais 493.022 (96,97%) destinados a particulares e 15.419 (3,03%) às empresas. Em termos de distribuição trimestral, o quarto trimestre é aquele que apresenta, em média, um maior número de contratos celebrados, sendo o segundo trimestre aquele que apresenta um menor número de contratos celebrados. O valor médio anual dos contratos de Crédito Clássico situou-se nos 4.249€, valor que é bastante próximo do valor médio por contrato destinado a particulares (3.981€) e distante do destinado às empresas (13.144€). Embora os contratos celebrados com as empresas apresentem valores médios bastante superiores aos dos particulares, estes representam apenas 3,03% do total dos contratos celebrados.

4. HIPÓTESES E MODELO

Nesta secção apresentam-se as hipóteses testadas relativamente aos factores determinantes do crédito ao consumo e o modelo utilizado.

4.1. HIPÓTESES

Decorrente da análise descritiva do crédito ao consumo, estabeleceram-se diversas hipóteses sobre as variáveis que poderão determinar o crédito ao consumo, que se seguem:

H1: A concessão de crédito ao consumo (CASFAC) é determinada pelo Grau de Abertura ao Exterior (GAE).⁸

H2: A Procura Interna (PI) influencia a concessão de crédito ao consumo.⁹

H3: A concessão de crédito ao consumo é determinada pelas Vendas de Automóveis Ligeiros de Passageiros (VAACAP).

⁸ $G. A. E. = (Exportações + Importações) / PIB.$

⁹ Procura Interna = $C + I_B + G$, onde C é o Consumo, I_B é o Investimento Bruto, e G são os Gastos Públicos.

H4: As Importações (I) e as Exportações (E) influenciam a concessão do crédito ao consumo.

H5: A concessão de crédito ao consumo é influenciada pela riqueza gerada no país dada pelo Produto Interno Bruto (PIB).

4.2. DADOS

Como referido anteriormente, os dados relativos à concessão de crédito ao consumo têm frequência trimestral, totalizando 56 observações ao longo do período de 1998 a 2011, e foram cedidos pela ASFAC. Foi utilizado o deflador para os serviços de intermediação financeira do Eurostat. Não foi efectuado qualquer tipo de ajustamento sazonal prévio a esta série de dados antes de aplicar o deflador a preços constantes de 2005 ajustado sazonalmente.

Em relação às variáveis explicativas consideradas, os dados referentes às variáveis macroeconómicas, nomeadamente o PIB, as Importações, as Exportações e a Procura Interna, foram retirados do Eurostat. Foram extraídos os valores correntes ajustados sazonalmente e aplicados os deflatores específicos para cada variável. Todos os deflatores utilizados foram retirados do portal do Eurostat, encontrando-se a preços constantes de 2005 e ajustados sazonalmente.

Os dados relativos à venda dos veículos ligeiros de passageiros foram fornecidos pela ACAP (Associação Automóvel de Portugal)¹⁰. Também à série das vendas de automóveis ligeiros de passageiros foi retirado o efeito sazonal, aplicando o modelo multiplicativo de médias móveis através do *software* Eviews 7.

4.3. MODELO

Foi utilizado um modelo de regressão linear com a seguinte forma geral $y_t = \alpha + \beta x_t + \gamma y_{t-j} + \delta d_t + u_t$. A variável dependente, y_t , representa o crédito ao consumo. O termo constante da regressão é representado por α . Os parâmetros β , γ e δ , captam a magnitude e o sinal das variáveis independentes x_t , y_{t-j} e d_t (variável dummy). A variável aleatória residual, u_t , procura incluir todas as influências na variável dependente que não podem ser explicadas linearmente pelas variáveis independentes (Brooks, 2008; Wooldridge, 2002).

O método dos mínimos quadrados foi utilizado na estimação dos modelos econométricos. Na prática, foram estimados seis modelos de regressão múltipla com diferentes variáveis explicativas, de acordo com as hipóteses estabelecidas e com o objectivo de comparar as diferenças em termos de ajustamento.

Previamente, foi analisada a estacionariedade das séries temporais de modo a evitar o fenómeno da regressão espúria que ocorre quando as variáveis não estacionárias incluídas no modelo conduzem a um coeficiente de determinação (R^2) elevado, consequência da

¹⁰ www.acap.pt

existência de uma tendência comum e não de uma relação linear entre elas (Wooldridge, 2002). Realizou-se o teste *Augmented Dickey-Fuller* (ADF) para detecção de raízes unitárias. A hipótese nula do teste, H_0 , admite a presença de uma raiz unitária. Quando as variáveis não verificam a hipótese de estacionariedade, o teste aplica-se às primeiras diferenças logarítmicas das séries como forma de as estacionarizar (Gujarati, 2003). A Tabela 1 permite concluir que a Procura Interna e o PIB são estacionários na forma logarítmica. Assim, o teste foi aplicado às primeiras diferenças logarítmicas das restantes variáveis, por uma questão de uniformização e interpretação dos resultados. Todas verificam a condição de estacionariedade.

Tabela 1: Resultados do teste Augmented Dickey-Fuller

Variáveis	LOG_CASFAC	LOG_GAE	LOG_PI	LOG_ACAP	LOG_IMP	LOG_EXP	LOG_PIB
<i>Estatística do teste ADF</i>	-2,43	-0,85	-3,42	-2,29	-1,56	-1,12	-3,27
<i>Valores críticos do teste</i>							
1%	-3,57	-3,57	-3,57	-3,57	-3,57	-3,57	-3,57
5%	-2,92	-2,92	-2,92	-2,92	-2,92	-2,92	-2,92
10%	-2,60	-2,60	-2,60	-2,60	-2,60	-2,60	-2,60
<i>Probabilidade</i>	0,14	0,79	0,01	0,18	0,50	0,70	0,02
Variáveis	DLOG_CASFAC	DLOG_GAE	DLOG_PI	DLOG_ACAP	DLOG_IMP	DLOG_EXP	DLOG_PIB
<i>Estatística do teste ADF</i>	-11,29	-6,38	-6,47	-8,58	-6,51	-6,17	-6,49
<i>Valores críticos do teste</i>							
1%	-3,57	-3,57	-3,57	-3,57	-3,57	-3,57	-3,57
5%	-2,92	-2,92	-2,92	-2,92	-2,92	-2,92	-2,92
10%	-2,60	-2,60	-2,60	-2,60	-2,60	-2,60	-2,60
<i>Probabilidade</i>	0,00	0,00	0,00	0,00	0,00	0,00	0,00

A verificação de todos os pressupostos do modelo de regressão linear garante que os estimadores obtidos através do método OLS apresentam as propriedades óptimas contidas no teorema de *Gauss-Markov*.

Segundo Gujarati (2003), analisou-se a presença de heterocedasticidade através do teste de *White*. Os modelos apresentaram p-valor que variam entre 0,57 e 0,93, não se rejeitando a hipótese nula e assegurando-se assim a ausência de heterocedasticidade (Tabela 2).

Para detectar a presença de autocorrelação dos erros procedeu-se à análise do correlograma dos resíduos dos modelos, assim como à realização do teste de *Breusch-Godfrey*.

A hipótese nula, H_0 , testa a ausência de autocorrelação dos erros no modelo até quatro defasamentos¹¹. Todos os modelos apresentam ausência de autocorrelação dos erros após a aplicação do teste de *Breusch-Godfrey*, com resultados entre 0,68 e 0,91.

Tabela 2: Resultados dos testes White, Breusch-Godfrey, e Jarque-Bera

Modelos	M1	M2	M3	M4	M5	M6
Teste White						
<i>F-statistic</i>	0,67	0,33	0,45	0,43	0,79	0,71
<i>Prob. F(8,41)</i>	0,72	0,95	0,88	0,90	0,61	0,68
<i>Obs*R-squared</i>	5,75	3,00	4,03	3,87	6,68	6,05
<i>Prob. Chi-Square(8)</i>	0,68	0,93	0,85	0,87	0,57	0,64
<i>Scaled explained SS</i>	5,14	3,78	4,43	3,92	6,38	6,68
<i>Prob. Chi-Square(8)</i>	0,74	0,88	0,82	0,86	0,60	0,57
Teste Breusch-Godfrey						
<i>F-statistic</i>	0,30	0,47	0,51	0,21	0,21	0,37
<i>Prob. F(4,42)</i>	0,88	0,76	0,73	0,93	0,93	0,83
<i>Obs*R-squared</i>	1,38	2,15	2,32	0,97	1,00	1,70
<i>Prob. Chi-Square(4)</i>	0,85	0,71	0,68	0,91	0,91	0,79
Teste Jarque-Bera						
<i>Mean</i>	0,00	0,00	0,00	0,00	0,00	0,00
<i>Median</i>	-0,01	0,00	0,00	0,00	-0,01	0,01
<i>Maximum</i>	0,17	0,11	0,14	0,13	0,18	0,13
<i>Minimum</i>	-0,18	-0,22	-0,21	-0,19	-0,20	-0,23
<i>Std. Dev</i>	0,07	0,06	0,07	0,06	0,07	0,07
<i>Skewness</i>	0,11	-0,60	-0,45	-0,22	0,03	-0,46
<i>Kurtosis</i>	3,12	3,97	3,59	3,39	3,25	3,61
<i>Jarque-Bera</i>	0,13	4,99	2,42	0,72	0,14	2,51
<i>Probability</i>	0,94	0,08	0,30	0,70	0,93	0,28

Para comprovar a normalidade dos resíduos foi aplicado o teste de *Jarque-Bera* (Greene, 2003). A probabilidade da estatística do teste varia entre 0,08 e 0,94, não se rejeitando assim a hipótese nula da normalidade dos resíduos. O valor de 0,08 é registado no modelo que

¹¹ Devido à periodicidade das séries de dados utilizadas nos modelos foi escolhido um defasamento de quatro períodos. Ver Brooks (2008), p.149.

inclui a Procura Interna, o que apresenta um problema apenas para quando se testa com um nível de significância igual ou superior a 10%.

Para analisar a existência de erros de especificação, utilizou-se o teste *Ramsey Reset*, o qual tem como objectivo avaliar se o modelo falhou em captar não linearidades importantes. A não rejeição da hipótese nula, H_0 , valida a correcta especificação do modelo. Todos os modelos testados apresentaram valores entre os 0,52 e os 0,93, encontrando-se correctamente especificados (Tabela 3).

Tabela 3: Resultados do teste Ramsey Reset

Modelos	M1	M2	M3	M4	M5	M6
Teste Ramsey Reset						
<i>F-statistic (2,44)</i>	0,07	0,66	0,39	0,57	0,22	0,15
<i>Likelihood ratio (2)</i>	0,15	1,48	0,89	1,27	0,51	0,33
<i>Probability F</i>	0,94	0,52	0,68	0,57	0,80	0,86
<i>Probability LR</i>	0,93	0,48	0,64	0,53	0,78	0,85

De forma a avaliar se existe um elevado grau de multicolinearidade, foi calculada uma matriz de correlações entre as variáveis independentes para detectar a existência de correlações muito elevadas (Tabela 4).¹² Foi possível observar que o valor mais elevado se registou entre as Importações e o termo desfasado da concessão de crédito ao consumo, representando 18,42%, concluindo-se que não existe um elevado grau de correlação entre as variáveis.

Outro método utilizado foi o VIF (*Variance Inflation Factors*), que mede o nível de colinearidade entre os regressores. O método mostra como a variância de um estimador é inflacionada pela presença de multicolinearidade. Caso não exista colinearidade entre duas variáveis, o VIF apresentará o valor de 1, caso apresente um valor superior a 10 diz-se que é altamente colinear¹³. Observou-se que os valores registados aproximam-se de um, concluindo-se assim que não existe um elevado grau de colinearidade entre as variáveis independentes presentes nos modelos (Tabela 5).

¹² Segundo Gujarati (2003, p. 359), caso existam correlações acima dos 0,8 existe grande possibilidade de a multicolinearidade se tornar um problema.

¹³ Ver Gujarati (2003), p. 351 e p. 362.

Tabela 4: Matriz de correlações das variáveis dos modelos

	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_GAE</i>
M1	<i>DLOG_CASEFAC(-1)</i>	1,00	0,13
	<i>DLOG_GAE</i>	0,13	1,00
	<i>Q_t</i>	-0,16	-0,04
	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_PI</i>
M2	<i>DLOG_CASEFAC(-1)</i>	1,00	-0,01
	<i>DLOG_PI</i>	-0,01	1,00
	<i>Q_t</i>	-0,16	0,05
	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_ACAP</i>
M3	<i>DLOG_CASEFAC(-1)</i>	1,00	-0,11
	<i>DLOG_ACAP</i>	-0,11	1,00
	<i>Q_t</i>	-0,16	0,09
	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_IMP</i>
M4	<i>DLOG_CASEFAC(-1)</i>	1,00	0,08
	<i>DLOG_IMP</i>	0,08	1,00
	<i>Q_t</i>	-0,16	0,01
	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_EXP</i>
M5	<i>DLOG_CASEFAC(-1)</i>	1,00	0,18
	<i>DLOG_EXP</i>	0,18	1,00
	<i>Q_t</i>	-0,16	-0,10
	Variável	<i>DLOG_CASEFAC(-1)</i>	<i>DLOG_PIB</i>
M6	<i>DLOG_CASEFAC(-1)</i>	1,00	0,06
	<i>DLOG_PIB</i>	0,06	1,00
	<i>Q_t</i>	-0,16	-0,03

Tabela 5: Resultados do teste VIF

	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M1	<i>C</i>	0,00	1,46	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,07	1,04
	<i>DLOG_GAE</i>	0,17	1,07	1,02
	<i>Q²</i>	0,00	1,39	1,03
	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M2	<i>C</i>	0,00	1,49	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,05	1,03
	<i>DLOG_PI</i>	0,81	1,09	1,00
	<i>Q²</i>	0,00	1,39	1,03
	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M3	<i>C</i>	0,00	1,42	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,05	1,03
	<i>DLOG_ACAP</i>	0,01	1,01	1,01
	<i>Q²</i>	0,00	1,39	1,03
	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M4	<i>C</i>	0,00	1,47	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,06	1,03
	<i>DLOG_IMP</i>	0,10	1,07	1,01
	<i>Q²</i>	0,00	1,39	1,03
	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M5	<i>C</i>	0,00	1,52	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,09	1,06
	<i>DLOG_EXP</i>	0,12	1,13	1,04
	<i>Q²</i>	0,00	1,39	1,03
	Variável	Coefficient Variance	Uncetered VIF	Centered VIF
M6	<i>C</i>	0,00	1,54	NA
	<i>DLOG_CASEFAC(-1)</i>	0,01	1,06	1,03
	<i>DLOG_PIB</i>	1,47	1,12	1,00
	<i>Q²</i>	0,00	1,39	1,03

5. RESULTADOS

Analisando os resultados das estimações dos modelos, observa-se que todas as variáveis incluídas são estatisticamente significativas a um nível de significância entre 1% e 5% (Tabela 6).

Todos os modelos estimados revelaram-se estatisticamente significativos a um nível de significância de 1%, com um grau de ajustamento entre 40,91% e 52,23%.

As variáveis comuns aos modelos estimados são o crédito ao consumo com um desfazamento de um período e uma dummy sazonal, Q4, que representa o 4.º trimestre de cada ano do período em análise. É possível concluir que um aumento de 1% na variação do crédito concedido no período anterior, conduz, em média, a um decréscimo entre 0,41% e 0,46% na variação da concessão do crédito corrente, *ceteris paribus*. Com a inclusão da dummy sazonal, que apresenta coeficientes estatisticamente significativos entre 0,08 e 0,09, para um nível de significância de 1%, confirma-se a presença de sazonalidade.

A hipótese 1 deste estudo é analisada através do modelo 1, no qual se confirma que uma maior abertura da economia ao exterior influencia positivamente a concessão do crédito, sendo que um aumento de 1% na variação deste indicador resulta em média num acréscimo de 1,43% na variação do crédito concedido.

A Procura Interna, presente no modelo 2, apresenta um coeficiente de 3,71, sendo a variável com o maior coeficiente estimado, quando comparado com os outros modelos. Conclui-se, perante a hipótese 2 deste estudo, que um aumento do consumo e da capacidade produtiva por parte das empresas¹⁴ influencia fortemente a concessão de crédito.¹⁵

Através da análise do modelo 3 é possível confirmar que a venda de automóveis ligeiros influencia a concessão de crédito, apresentando a variável um coeficiente de 0,23, estatisticamente significativo a um nível de significância de 1%.

De forma a responder à hipótese 4, e assim analisar a relação das Importações e Exportações com a concessão de crédito ao consumo, é necessário analisar os modelos 4 e 5. As Importações revelam ser mais determinantes na concessão de crédito do que as Exportações, apresentando o modelo 4 um grau de ajustamento bastante superior ao do modelo 5. A variável Importações é estatisticamente significativa a um nível de significância de 1%, apresentando um coeficiente de 1,34. As Exportações apresentam um coeficiente de 0,88, que é estatisticamente significativo a um nível de significância de 5%.

No modelo 6 foi incluída a variável PIB de forma a serem retiradas conclusões acerca da relação entre a riqueza gerada no país e a concessão de crédito por parte da ASFAC. Observa-se que o PIB apresenta um coeficiente elevado de 3,13, sendo estatisticamente significativo a um nível de significância de 5%.

¹⁴ Neste caso corresponde à rubrica de Investimento no cálculo da Procura Interna.

¹⁵ Consumo efectuado pelos agentes privados e públicos.

Tabela 6: Resultados da estimação dos modelos

Variáveis	M 1	M 2	M 3	M 4	M 5	M 6
<i>C</i>	-0,006 (0,012)	-0,009 (0,012)	0,002 (0,012)	-0,008 (0,011)	-0,007 (0,013)	-0,008 (0,013)
<i>CASEFAC (-1)</i>	0,457*** (0,109)	0,409*** (0,103)	0,411*** (0,112)	0,444*** (0,102)	0,459*** (0,115)	0,426*** (0,113)
<i>GAE</i>	1,432*** (0,418)	-	-	-	-	-
<i>PI</i>	-	3,708*** (0,900)	-	-	-	-
<i>VAACAP</i>	-	-	0,230*** (0,081)	-	-	-
<i>IMP</i>	-	-	-	1,343*** (0,310)	-	-
<i>EXP</i>	-	-	-	-	0,882** (0,350)	-
<i>PIB</i>	-	-	-	-	-	3,129** (1,213)
<i>Q_t</i>	0,087*** (0,023)	0,081*** (0,022)	0,080*** (0,024)	0,084*** (0,022)	0,089*** (0,024)	0,087*** (0,024)
R ²	0,497	0,539	0,463	0,552	0,445	0,448
Adj R ²	0,464	0,509	0,428	0,522	0,409	0,412
n	50	50	50	50	50	50
F-Statistic	15,138***	17,911***	13,238***	19,855***	12,309***	12,464***

Notas: *, ** e *** indicam os níveis de significância de 10%, 5% e 1% . O valor entre parêntesis é o desvio-padrão.

6. CONCLUSÕES

O crédito total ao consumo tem sido pouco estudado. Este artigo teve como objetivo analisar as variáveis mais relevantes na sua evolução, atendendo à dimensão deste fenómeno na actualidade. Através da análise descritiva concluiu-se que o crédito ao consumo concedido pela ASFAC, entre 1998 e 2011, revelou uma tendência crescente, com o peso dominante do Crédito Clássico e do Crédito Stock, apesar da forte quebra registada entre 2007 e 2011.

Da análise econométrica concluiu-se que um aumento de 1% na variação do crédito ao consumo concedido no período anterior, resulta, em média, num decréscimo entre 0,41% e 0,46% na variação da concessão do crédito no período corrente. A inclusão do termo autoregressivo desta variável nos modelos foi indispensável para que estes fossem validados nos testes a que foram sujeitos. Foi também identificada a presença de sazonalidade no quarto trimestre. Quando as variáveis macroeconómicas são consideradas como variáveis explicativas, concluiu-se que o modelo que apresenta o melhor grau de ajustamento é o que inclui as Importações, sendo que um aumento de 1% nas Importações, provoca, em média, um aumento de 1,34% na variação do crédito concedido.

Para os decisores políticos esta análise é bastante pertinente com vista, por exemplo, a implementação de medidas de fomento da poupança dos particulares. Investigação futura deverá explorar outras variáveis explicativas do comportamento do crédito ao consumo, nomeadamente a competição crescente no mercado de oferta de crédito ao consumo, que poderá explicar o sobrendividamento dos particulares.

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AS REFORMAS MONETÁRIAS E O EURO¹

João Sousa Andrade

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ABSTRACT

The creation of the Euro is discussed in this text in the context of the monetary reforms historically proposed by economists. Our reflection is made in terms of monetary orders based on commodities, the consequences of the legal tender and not convertible money, and includes the proposals for the free money. The way the money supply is created, generating its own demand, is essential to understanding the new monetary order arising from the Euro. The 100 percent reserves reform, the Mervyn King's proposal, and the extension of the function of lender of last resort are referred. We conclude by drawing attention to the need of an increased integration that leads to a more stable and credible Euro area, as well as to greater protection against financial shocks for Portugal after all.

Keywords: Euro; monetary reforms; money supply; and monetary stabilization.

JEL Classification: E42; E51; E58; E60.

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Esta intervenção visa enquadrar a reforma monetária que levou à criação do Euro, no processo de integração europeu, no contexto das reformas monetárias propostas para a organização das ordens monetárias. O tema central acaba assim por ser a moeda, bem que representa a forma mais geral dos direitos de propriedade privada e da qual o senso comum se mantém afastado da sua compreensão conceptual (Menger, 2012, von Mises, 1953, e Chaîneau, 1993, 2013). A moeda deve o seu valor à aceitabilidade generalizada, à possibilidade de troca generalizada e à sua disponibilidade temporal e espacial, não ao valor do papel que a representa, porque esse nem para tirar notas pessoais é útil. Porque assim é, as formas monetárias sem valor intrínseco correspondem a organizações sociais evoluídas.

O desenvolvimento do capitalismo exigiu a existência de “ordens monetárias” estáveis. Não teve o poder político a confiança dos indivíduos quanto à criação de uma moeda da sua exclusiva responsabilidade devido à instabilidade do seu valor. O poder político, com a sua necessidade permanente de receitas, destruía o valor da moeda. Lembremos a frase de Benjamin Franklin, que nada é mais certo que a morte e os impostos. Não conseguindo impostos o governo emitia moeda para se financiar, assim, a criação de moeda foi atribuída, muitas vezes, a agentes privados que compensavam adequadamente os cofres do Estado pela concessão de tal privilégio. De qualquer forma, a desconfiança na moeda não era eliminada e por isso os padrões metálicos dominaram durante muito tempo.

1. PADRÕES DE BENS FÍSICOS

Foram várias as razões que levaram os metais preciosos a serem os escolhidos para representarem unidades monetárias. Ainda hoje temos saudosistas de um padrão-ouro, unidades monetárias representando um dado peso de ouro. No passado a sua importância foi tal, que a nossa velha moeda, o Escudo, apenas abandonou a designação de “Escudo-Ouro” após a reforma de 1975.

A subida do preço do petróleo nos anos setenta do século passado deu ânimo aos proponentes de um padrão-mercadorias. Os próprios EUA simpatizaram com a ideia, face aos disparar dos preços do petróleo. Seria uma forma de se protegerem da transferência de riqueza para os países da OPEC. E de resto, não eram conhecidas experiências deste tipo nos E.U.A.? Um “padrão-tabaco” funcionou durante dois séculos no Estado da Virgínia e um século e meio no Maryland (Walton e Rockoff, 2013, e Staples e Shaw, 2013).

A grande vantagem de um padrão-mercadoria reside no facto de a criação de moeda estar aparentemente subtraída ao poder discricionários dos governos. Uma das suas desvantagens reside na sua falta de elasticidade: o *stock* das mercadorias padrão não tem relação com as necessidades da economia. A desestabilização pela inflação e deflação são a consequência da ausência de elasticidade. Por outro lado, o seu fundamento não elimina o abuso dos créditos aos governos com a consequente desconfiança que acaba por recair sobre a moeda.

2. MOEDA DE CURSO FORÇADO

As ordens monetárias atuais, no sentido que lhe deu Robert Mundell, caracterizam-se pela moeda ter “curso legal” e “curso forçado”. No seu espaço político de circulação é obrigatória a sua aceitação em pagamentos e não são convertíveis em quaisquer bens que assumam o papel de garante oficial do seu valor. Em suma, o comerciante não pode recusar que lhe paguem nessa moeda e o assalariado não pode recusar que lhe paguem o salário nessa mesma moeda.

Símbolo do poder centralizador do *príncipe* a existência de moeda teve de afrontar as tendências desagregadoras nacionalistas. Uma bandeira, uma moeda. Não temos de ir mais longe que lembrar o Zarco, para a Madeira, e o Açor, para os Açores, no pós-revolução do 25 de abril.

No passado, perante a anarquia da circulação de várias moedas, o capitalismo desenvolveu-se caminhando para o monopólio público da criação e emissão de moeda. As finanças públicas deficitárias empurravam a “moeda pública” para a perda de valor e a instabilidade. O ponto culminante das reformas para a adequada emissão de moeda situou-se em Inglaterra, entre 1820 e 1845 e refletiu-se na polémica entre a *Currency School* e a *Banking School* (Goodhart e Jensen, 2015, e Dorofteia, 2013) precursoras das principais correntes do pensamento monetário. Uma corrente menor fez também aí a sua aparição: a *Free Banking School* (Schwartz, 2008), que defendia a liberdade de emissão de moeda. Esta tendência reapareceu em contraposição à proposta animada por Jacques Delors de uma moeda única para a Europa (Delors, 1992).

3. O MUNDO IDÍLICO DO *FREE MONEY*

A posição dos pais da economia, Adam Smith, David Ricardo, Leo Walras e Jean-Baptiste Say, era clara: “o poder público porta-se mal com a emissão de moeda, mas entregá-la a privados é um risco excessivo” (Andrade, 1987). Os economistas liberais da *Free Money* (Yeager, 1983a, 1983b) contrapõem que os princípios do bem-estar dos consumidores se devem aplicar também à moeda e por isso a concorrência deve existir quanto à produção de moeda. São vários os problemas que de imediato identificamos:

1. o passado revelou que os sistemas com concorrência de moedas foram desastrosos para a estabilidade monetária;
2. os princípios da economia do bem-estar não podem ser aplicados à escolha dos consumidores perante a concorrência das moedas porque a utilidade de posse de uma dada moeda não é independente da utilidade que os restantes agentes tiram dessa mesma posse;
3. os atuais sistemas monetários são mistos: a par de uma moeda pública, as notas e moedas de trocos, temos moeda escritural, emitida por bancos de depósitos, que hoje movimentamos sobretudo através de cartões eletrónicos. Esta “moeda privada”, sujeita à convertibilidade a 100% em moeda pública, em notas, nunca protegeu os seus possuidores da perda de valor de compra em situações de inflação; como

podemos então provar que uma moeda privada sem necessidade de convertibilidade o iria fazer?

4. a concorrência entre “produtores” dessas moedas vai levar ao monopólio: à medida que o espaço de circulação de uma moeda aumenta reduzem-se os custos e aumentam os benefícios da sua utilização. No final apenas um produtor existirá, pelo que a própria reforma se auto-elimina.

3.1. CONCORRÊNCIA DE MOEDAS NACIONAIS NA EUROPA

O “Manifesto do Dia de Todos-os-Santos” (Fratanni et al., 1975) propunha para a (atual) União Europeia (UE) a emissão de uma nova moeda a “Europa” com poder de compra constante que circularia em concorrência com as moedas nacionais. Seria assim respeitado o princípio da livre escolha dos consumidores. A presença desta nova moeda levaria a que as moedas nacionais fossem pouco a pouco abandonadas restando finalmente a nova moeda. Sobretudo em países de elevada inflação seria rápido o período de transição e o processo seria, por isso, desestabilizador.

Em 1989, o *Chancellor of the Exchequer* inglês, Nigel Lawson, propôs que as moedas nacionais tivessem curso legal em toda a área da UE originando-se assim um processo de concorrência de moedas levando a que os consumidores pudessem em plena liberdade escolher a moeda que desejassem (Wood, 1992). Em 1990 o sucessor de Nigel Lawson, o futuro primeiro-ministro John Major juntou a presença de uma nova moeda que existiria em paralelo com as moedas nacionais, o “ECU-forte” ou “*Hard-Ecu*” (Holmes, 2001). Ambos os projetos foram recusados. Mas convém lembrar que John Major, declararia numa entrevista que estava convencido que num futuro não muito distante a Libra viria a ser tão forte como o Marco alemão (Holmes, 2001, p. 32).

A ideia de concorrência das moedas não andou assim longe dos europeus (Issing, 1999).

4. COMO SE PRODUZ MOEDA?

O conceito de criação de moeda não é dos de mais fácil compreensão em economia. À moeda, como a qualquer outro bem, podemos aplicar o conceito de procura e oferta. Os indivíduos procuram moeda tendo em conta a sua riqueza (ou o seu rendimento), o consumo pretendido, a inflação e o seu custo de oportunidade em termos da taxa de juro. Mas quem a oferece? Os bancos. Os bancos através das suas operações de crédito colocam na economia (não bancária) as notas e os seus depósitos: moeda pública e privada.

A oferta de moeda resulta do confronto de interesses dos bancos e, sobretudo, das unidades de produção. Estas pretendem crédito dos bancos, porque desejam meios de financiamento. A essa procura de financiamento corresponde uma oferta de crédito por parte dos bancos. A oferta de moeda vai criar uma quantidade de meios de pagamento a favor das unidades de produção, que de imediato os usarão. As unidades de produção não pretendem moeda para acumular, mas antes para fazer pagamentos, para investir,

pagar bens que compram e ainda salários. Essa moeda estará em circulação a partir do momento que o crédito foi concedido. Ela vai ser possuída por alguém que afinal nada teve a ver com o seu processo de criação. Oferta e procura de moeda são conceptualmente diferentes.

Vejam os que se passa de diferente com um qualquer mercado de um outro bem. Se a oferta de um bem for superior à sua procura, para um preço tomado como caracterizando o mercado, é natural que no período seguinte a oferta seja inferior. Aliando este comportamento ao facto de a produção ser feita porque se antecipa uma vontade de comprar porque parte de outros agentes, podemos dizer que a procura, ou o que se espera que ela seja, precede a oferta. Associado ao fenómeno da oferta encontramos o da procura antecipada. Ou, de outra forma, a procura constrange a oferta. Veja-se o que acontece com a moeda. A oferta de moeda precede a procura. Como insistia Chaîneau (1995, 2000), a oferta de moeda leva à criação de moeda que acaba por ser possuída pelos agentes da economia. Os agentes não têm outra alternativa que possuir essa quantidade criada. Não podemos conceber a existência de moeda sem um seu proprietário. Para além de a oferta preceder a procura de moeda, esta última não tem qualquer influência sobre a oferta de moeda. Os bancos não antecipam variações da procura de moeda para definirem a sua política de concessão de crédito às unidades de produção.

A relação que se estabelece entre procura e oferta leva a distinguir a moeda dos restantes bens. As diferenças são mesmo substanciais. De forma alguma podemos dizer que a moeda é mais um bem na economia. Temos de facto uma procura e uma oferta, mas elas são independentes. Por isso, é natural que tenhamos um valor da oferta de moeda inferior ou superior àquele outro valor da procura de moeda. Se tivermos uma diferença positiva, isso equivale a uma posição de sobre-liquidez de que resultará uma maior procura de bens e de ativos financeiros e portanto um aumento do valor nominal das vendas e uma redução da taxa de juro. Se bem que o equilíbrio *ex post* seja logicamente uma necessidade, isso não significa que o equilíbrio obtido corresponda necessariamente aos valores que foram antecipados pelos agentes possuidores de encaixes monetários.

O grande economista John Hicks contribuiu para uma grande confusão: ao considerar a moeda como mais um bem cuja característica distintiva residia na sua “liquidez”. A especificidade da moeda era anulada e depressa a vulgata keynesiana passaria a falar do “mercado da moeda” em paralelo com os outros mercados – como se um mercado altamente profissional de créditos de curto prazo em que participam os bancos não existisse já nas economias, esse sim “o mercado monetário”. A problemática do equilíbrio monetário era reduzida a mais um mercado e a distinção fundamental lembrada por Patinkin (1965) entre o “individual experiment” e o “market experiment”, que autores como Walters (1998) e Matthews e Peel (2004) e Laidler (1975, 2004), tão bem souberam identificar no estudo da inflação e que seria posteriormente representada econometricamente no sistema proposto por (Johansen, 1991, 1995) acabaria por ser ignorada. Essa incapacidade do keynesianismo vulgar leva ainda hoje à incapacidade de representação adequada do fenómeno da “liquidity trap” e à não identificação do problema da oferta de moeda no cerne desta situação.

5. A OFERTA DE MOEDA NO CENTRO DAS ORDENS MONETÁRIAS

Como sugerimos atrás, a oferta de moeda está no cerne das ordens monetárias.

A Inglaterra não suspendeu o padrão-ouro no seguimento da primeira GM, mas de 1916 a 1919 a cotação da Libra era mantida graças ao crédito de J. P. Morgan and Co., de Nova Iorque. O Banco de Inglaterra não tinha condições para assegurar a convertibilidade da Libra. O padrão-ouro foi suspenso quando a casa americana recusou o prolongamento do contrato (Bernanke e James, 1991, Eichengreen, 2008, e Duarte, 2015). Anos mais tarde, Montagu Norman, Governador do Banco de Inglaterra, faz uma proposta típica de um império que havia deixado de o ser, reclama a criação de uma rede de bancos centrais independentes dos governos, que cooperariam entre si, dirigidos de forma discreta pelo Banco de sua Majestade, obviamente. A “conta” seria paga pela Comissão Financeira da Sociedade das Nações (Cain e Hopkins, 2016).

Quando em 1933 os EUA suspendem o padrão-ouro, desvalorizando o dólar, alguns países mantiveram-se ligados ao ouro. Não foram as conferências que resolveram o relacionamento dos dois blocos: o “bloco-dólar” e o “bloco-ouro”. A deflação no “bloco-ouro” resolveu o problema. As moedas ligadas ao dólar desvalorizavam-se face às moedas referidas ao ouro, o que provocou nestas últimas economias a deflação com a consequente queda da produção e aumento do desemprego.

Na primeira metade dos anos 80 do século passado, a Inglaterra opôs-se à transição para uma moeda única na Europa. O que é o mesmo, recusou perder de vez o papel imperialista que teve na história. A perda da Libra, como moeda internacional, corresponde ao caminho sem retrocesso iniciado desde o início do século passado. Mas não se fecha uma história imperialista de vontade própria. Uma das propostas que chegou a ser invocada, aproveitando argumentos liberais, propunha que em vez da criação artificial de uma moeda se admitisse a livre escolha de moedas nas transações, o que levaria ao início de um período de concorrência entre moedas, que permitiria que os agentes escolhessem a melhor moeda. De uma forma populista quase se dizia, “sim à moeda escolhida pelos consumidores”, “não à moeda escolhida por Bruxelas”. A inspiração Hayekiana da posição era óbvia. Mas uma reforma deste tipo envolve custos elevadíssimos, económicos e políticos. Os ingleses estavam seguros que ela não poderia ser experimentada. A sua não exequibilidade seria a sua principal característica, mas travaria o processo de integração monetária na Europa. Se os agentes económicos pudessem escolher em liberdade uma moeda, com certeza escolheriam a que maiores garantias lhes desse de manutenção do poder de compra, na altura: o florim e o marco. E até a escolha do florim era já uma escolha do marco (Holmes, 2001, p. 90). Afinal a escolha do mercado não se afastaria da “escolha de Bruxelas”.

Ainda a Segunda Grande Guerra não havia terminado e já se preparava a reforma para uma nova ordem monetária que iria suceder ao “império do esterlino”. As regras dos acordos de Bretton-Woods eram a confirmação ao nível económico da nova potência imperialista: os EUA. Resumindo, o dólar norte-americano passava a ser tão bom como o ouro, mas apenas na primeira metade dos anos sessenta esta moeda ultrapassou a Libra nos pagamentos internacionais. A emissão de moeda por parte dos EUA para pagar os seus desequilíbrios externos e um sistema de câmbios praticamente fixos ditaram a inflação mundial crescente, a partir sobretudo da segunda metade dos anos sessenta.

A não independência dos bancos centrais do respetivo poder político levava a políticas orçamentais expansionistas independentemente dos ciclos económicos. A dívida pública podia ser financiada pelos bancos centrais com taxas de juro muito baixas. Desde que a oferta de moeda não levasse as economias nacionais a taxas de inflação superiores à dos EUA, o *pivot* desta ordem, o sistema era estável. A inflação, entretanto, reduzia o valor real da dívida. Um mundo perfeito para a irresponsabilidade a nível orçamental. Inflação crescente nos EUA e inflações crescentes e divergentes nos restantes países levaram ao fim da ordem de Bretton-Woods no início dos setenta. Como sabemos, foi neste contexto de forte e crescente instabilidade monetária que o projeto europeu de estabilidade cambial e posterior união monetária surgiram.

5.1. HAVERÁ REGRAS ÓTIMAS PARA A EMISSÃO DE MOEDA?

Os economistas conhecem através dos seus modelos, teóricos e empíricos, os custos associados à inflação e sobretudo à inflação não esperada. Então têm respostas precisas para a quantidade de moeda? Não, não têm! A primeira posição para um ótimo de bem-estar veio de uma representação demasiado abstrata de Friedman (1956) em que a oferta de moeda deveria em equilíbrio conduzir a economia a uma taxa de deflação (de decréscimo dos preços) idêntica à taxa de juro de equilíbrio. Esta situação provocaria a igualdade de taxas de rentabilidade dos ativos possuídos pelos indivíduos. Esta ideia é por vezes suportada por aqueles que argumentam que a produção de moeda por um banco central privado levaria este a reduzir a quantidade de moeda em circulação de forma a aumentar o poder de compra das unidades monetárias, afinal da sua produção. Ideia esta baseada num conceito de *senhoriagem* que não atende à forma como a moeda é criada e posta em circulação: pelo crédito bancário. A análise mais corrente sobre a taxa a que a moeda deve ser produzida, propõe uma leitura em termos do comportamento dos indivíduos quanto à moeda detida, quanto à procura de moeda. E neste caso, se o objetivo for a maximização dos lucros do banco central que a produz, então as taxas de inflação geradas serão insuportáveis: sempre acima dos 100% (Bofinger, 2006).

Estes argumentos reforçam a posição dos autores clássicos: os governos podem ser irresponsáveis mas apesar disso é preferível que a moeda seja produzida por um banco público e que procuremos definir as regras da emissão.

5.2. A LEI DE PEEL (1844) E O SEU APROFUNDAMENTO

A Lei de Peel (1844) é um marco importante no estabelecimento definitivo da produção de moeda de forma pública. E as propostas que se seguiram ao crescimento descontrolado da inflação na segunda metade do século passado, procuravam formas de controlo da quantidade de moeda. Ao mesmo tempo ficou claro para os economistas que a estabilidade monetária desejada para a economia é um fenómeno de longo prazo e que a prática dos governos os insere num contexto de curto prazo. Para alguns, isto representa uma incompatibilidade que apenas pode ser resolvida com a independência dos bancos centrais.

Embora não seja função dos bancos centrais lutar contra injustiças sociais, não nos esqueçamos do que representam elevadas taxas de inflação. Reavivemos a nossa memória. Em Portugal a taxa de inflação atingiu 28,5% em 1984, um máximo histórico. Desde 1978 que as taxas estavam na casa dos 20%. 500 escudos no início de 1978 valiam apenas 127 escudos em 1984. As taxas de juro para créditos a mais de 1 ano andavam por valores superiores a 32,5%. Quem tivesse pedido 100 escudos no início de um dado ano, ao fim de 5 anos devia mais de 4 vezes aquele valor. O USD cuja cotação histórica eram os 28 escudos e 50 centavos valia em 1984 170 escudos. Quem tinha poder reivindicativo podia corrigir esta desvalorização nominal, os que não tinham, viam os seus rendimentos cair. Errar em 50% a previsão da taxa de inflação significava um erro absoluto de 15% no seu valor, fatal para empresas e, ou, trabalhadores. Uma ordem monetária que não respeita a estabilidade monetária contribui para uma sociedade de conflitos e de desespero de muitos. A única solução será continuar a aumentar os défices públicos, continuar assim a aumentar a inflação? Até onde? Esta é naturalmente uma falsa solução.

E afinal o problema não reside nas finanças públicas e no oportunismo de governos que pretendem fazer despesas sem que para tal tenham as receitas correspondentes, no curto ou longo prazos? Uma ordem monetária dominada pelo poder político é uma ameaça à estabilidade da economia e ao bem-estar.

Símbolo do poder, da soberania, sobre um território, a moeda sofreu a erosão que essa mesma soberania foi sofrendo com a integração económica, social e política. O controlo de uma moeda própria continua a ser crucial à irresponsabilidade orçamental fazendo com que consumidores, em geral, e trabalhadores em particular, no ativo ou reformados, cubram esses custos.

6. OUTRAS REFORMAS MONETÁRIAS

6.1. UMA REFORMA LIBERAL RADICAL: RESERVAS BANCÁRIAS A 100%

A Islândia foi exemplar na responsabilização criminal de responsáveis bancários pela crise bancária de 2008 no país. Na reavaliação das responsabilidades de supervisão por parte do seu banco central a *Reforma dos 100%* foi reavivada com uma proposta avançada no parlamento islandês (Sigurjónsson, 2015).

Ao *Crash bolsista* de 1929 sucederam-se, nos EUA, as crises bancárias de 1930 e 1931. Em 1933 o poder legislativo americano admite nacionalizar os bancos e em 1934 surge uma proposta para a criação de um único banco com o monopólio do crédito para os EUA. Dois economistas liberais vão sobressair no diagnóstico da situação de crise: Irving Fisher, (Fisher, 2009), com a sua insistência no sobre-endividamento, e Milton Friedman, que se foca na instabilidade da oferta de moeda criada pelos bancos (Friedman, 1960, 1967, e Benes e Kumhof, 2012). O projeto de “reservas a 100%”, ou seja, os bancos têm de deter em cofre um montante de notas idêntico aos depósitos que aceitam, elaborado por outro economista liberal, Henry Simons, circula no meio académico da Universidade de Chicago. Existe opinião favorável a tal reforma na administração Roosevelt. Nessa altura Irving Fisher será a figura mais conhecida do plano e, posteriormente, será Milton

Friedman. O objetivo: separar a função de crédito da criação de moeda e atribuir o controlo da quantidade de moeda que circula na economia ao governo! Pretendiam assim, preservar o capitalismo e evitar a nacionalização da banca! Se em 1939 200 economistas assinaram o manifesto da reforma, em 1941 já eram 400!

O poder dos banqueiros obviamente que não permitiu que os economistas liberais levassem a reforma avante e em consequência apenas o *Glass-Steagall Act* (1933) será aprovado. Nesta lei, que fará história nos sistemas bancários e monetários mundiais, é estabelecida a separação entre a banca comercial e a banca de investimento. Sendo esta última muito exigente em requisitos de capital e, por isso, tradicionalmente menos rentável, a pressão foi enorme para que o regime imposto por aquela Lei fosse abandonado. Em 1999 o *Gramm-Leach-Bliley Act* anulará a separação entre banca comercial e de investimento (Akhigbe e Whyte, 2004). Para muitos economistas tal não separação foi em parte responsável pela crise de 2008 e no conjunto das propostas para a reorganização bancária a separação voltou a ser reclamada. A voz com maior autoridade é a de Paul Volcker, o presidente do FED que se notabilizou no início dos anos oitenta pelo controlo da inflação, numa altura em que esta parecia estar descontrolada (Cassidy, 2010).

Seguramente a Reforma dos 100% terá, agora na Islândia, o mesmo destino que teve nos trinta do século passado nos EUA.

Para além da proposta apoiada por Paul Volcker que outras propostas de ordens monetárias surgiram no rescaldo da crise financeira de 2008?

6.2. A REFORMA DE MERVYN KING

Este professor de economia e ex-governador do Banco de Inglaterra (King, 2016) critica o desenvolvimento do conceito de incerteza traduzida em risco probabilizável e propõe que se tenha em conta o que ele designa por “incerteza radical”, re-introduzindo a ideia de incerta não-probabilizável keynesiana. Neste contexto propõe, em 2016, que os bancos centrais se constituam como “casa de penhores para todas as situações” (*pawnbroker for all seasons*). Cabe aos bancos centrais conceder crédito em qualquer situação aos bancos aceitando como penhora os seus ativos com base em desconto (*haircut*) a avaliar pelos bancos centrais. No fundo propõe a generalização do princípio enunciado por Walter Bagehot, em 1873, de “prestamista em última instância” (*Lender of Last Resort, LLR*) sem qualquer limite para além do valor dos ativos dos bancos socorridos. A reforma é em geral referida pela importância do proponente e não pela sua relevância. Como comentou (Krugman, 2016), como conciliar esta reforma com o princípio da “incerteza radical”? E que de novo, relativamente às regras hoje exigidas para o capital dos bancos, traz esta ideia? Esta proposta de Mervyn King é apenas uma alínea de uma reforma que inclui a eliminação do Euro com a reintrodução de moedas nacionais em regime de câmbios flexíveis. Nada de novo do outro lado do Canal.

6.3. O ALARGAMENTO DA FUNÇÃO DE “PRESTAMISTA EM ÚLTIMA INSTÂNCIA” (LLR)

Justifica-se que falemos desta função porque ela tem sido avançada sem qualquer referência à ideia original de Bagehot (1873) e Jeffers (2010). A ideia é simples: quando os governos não conseguem financiar-se a taxas razoáveis o banco central deverá comprar esses títulos. O banco central seria assim o “último credor”. É óbvio que tal comportamento eliminaria qualquer independência dos bancos centrais colocando-os como agências do Tesouro. A função de LLR faz hoje parte dos instrumentos de estabilização usados pelos bancos centrais. A ideia de Bagehot era de concessão de crédito a bancos solváveis em situação de crise de liquidez. Não se trata nem de emprestar a governos nem a bancos com falência à vista.

O FED alargou esta função a empréstimos a empresas não-bancárias com sucesso evidente na recente crise financeira. O Banco Central Europeu, quanto ao alargamento desta função, defrontou a frouxa integração política da UEM e apenas em 2106 começou a fazer este tipo de operações para introduzir diretamente liquidez na economia e não apenas pela via indireta do crédito a bancos.

7. CONCLUSÃO

Se os problemas identificados como traduzindo uma “preferência absoluta pela liquidez” caracterizassem a atual situação, poderíamos pensar em Silvio Gesell e na sua reforma que levava a validar as notas através de selos que corresponderiam a uma perda de valor da moeda equivalente a 5% (Gesell, 1958). Ou até pensar em Szilard (1949), o físico atômico, com a sua moeda de cor vermelha para ser usada em despesas e de cor verde para ser entesourada, mas esta estaria sujeita a desvalorização.

No mundo bipolar da Segunda Grande Guerra até ao início dos noventa, o bloco ocidental viveu, após a queda de Bretton-Woods, um período de forte instabilidade cambial. O Acordo do Plaza (1985) e o encontro de Paris (1987), (Taylor, 2015), se anularam conflitos cambiais centrados nas três moedas dominantes, o dólar, o marco e o iene, não levaram à desejada estabilidade. O Sistema Monetário Europeu (SME), estabelecido em março de 1979, veio trazer à Europa, lentamente, a tão desejada estabilidade cambial. O caminho não foi sem retrocessos. Em face da especulação acrescida a banda de flutuação das suas moedas passou dos 2,25% (e 6%) para os 15% em 1993. Os que já na altura anunciaram o fim do sistema, que afinal prosseguiu para a institucionalização do Euro, continuaram posteriormente a anunciar os vários fins do Euro. Como lembraram recentemente (Obstfeld e Taylor, 2017) o trilema clássico da política monetária enfatizava que a combinação de câmbios flexíveis com a mobilidade de capital permitia à política monetária preocupar-se com os objetivos nacionais. Fora desta análise estava, o que se revelaria de fundamental importância com a crise de 2009, a estabilidade financeira. Por si, a política monetária não é suficiente para a garantir e as pequenas economias estão muito mais sujeitas aos choques externos de natureza financeira. Neste mundo que abandonou a bipolaridade pertencer a uma zona monetária é um seguro contra esses choques externos. Não se conhecem, aliás, outras formas de proteção mais eficazes a esse risco.

A análise económica não garante que as regras de natureza orçamental sejam a melhor forma de governação, mas é necessário que haja governação! As regras orçamentais são assim necessárias para impedir a contaminação da instabilidade na ausência de governação orçamental europeia. O “fiscal compact” é um passo nesse sentido onde sobressai o “semestre europeu” como um elemento importante para essa governação.

A União Bancária é, já hoje, uma realidade e o seu processo de consolidação é irreversível (Véron, 2013, e Howarth e Quaglia, 2014).

A política monetária do BCE com Mario Draghi foi inovadora nas medidas de política monetária não convencionais. Se algumas das políticas foram demasiado lentas na sua aplicação isso ficou a dever-se à ausência de quadro institucional que apenas uma mais intensa integração europeia permitiria. De igual forma, a exigência de “responsabilização” e “transparência” necessitam de quadros institucionais que apenas maior integração política possibilita.

O Euro é um elemento fulcral nesta União Monetária que se pretende um espaço de estabilidade financeira e monetária, essencial ao crescimento do emprego e do bem-estar. Mas a União Monetária exige orçamentos sustentáveis. Uma mais intensa integração política permitirá uma política orçamental que contribuirá para políticas orçamentais ativas, evitando regras que geram ineficiências macroeconómicas. Se a resposta à crise grega em 2009 foi tardia, o mesmo não aconteceu posteriormente com a Irlanda e Portugal. A atitude do BCE evitou o alastramento da crise financeira a países como a Itália e a Espanha. A cobertura do risco de choques financeiros externos de que a nossa economia beneficia pela sua pertença à UEM exige a contribuição portuguesa para uma mais intensa integração política.

Em suma, as reformas monetárias propostas vão desde os padrões metálicos à moeda exclusivamente privada, passando pela imposição de reservas bancárias a 100%, mas também por outras formas menos radicais como o alargamento da função de prestamista em última instância. A reforma europeia de uma moeda única para um conjunto de países respeitando finanças públicas sustentáveis insere-se numa conceção clássica do papel da moeda na economia.

O Euro constitui o elemento essencial da reforma monetária europeia. A integração monetária como foi desenhada para a União Económica e Monetária (UEM) criou uma área de estabilidade monetária essencial ao crescimento do emprego e do bem-estar dos cidadãos europeus. Esta área é fundamental para pequenos países como Portugal para ficarem protegidos de choques financeiros e monetários externos. Mas a UEM para responder aos seus objetivos tem de assentar na sustentabilidade das finanças públicas. Sem uma integração política mais profunda a UEM tem de ser gerida por regras que levam a situações sub-ótimas pela sua própria natureza de regras. A União Bancária e o Euro constituem pilares da estabilidade bancária e monetária. Caminhar no sentido de maior integração a nível político é fortalecer essa estabilidade.

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