ESTIMATING THE IMPACT OF BANK MERGERS: AN APPLICATION TO THE PORTUGUESE BANKING SYSTEM*

*Diana Bonfim** | Pedro Pita Barros*** | Moshe Kim**** | Nuno C. Martins*****

ABSTRACT

Most studies assessing the impact of bank mergers analyze the differential impact of these processes on a number of variables that characterize the banking system. However, this approach has important limitations, ignoring endogenous changes in market structure that might occur after the merger. This article analyzes the impact on credit markets of a number of bank mergers in the Portuguese banking system using this methodology usually employed in the literature, as well as an alternative methodology based on the estimation of a structural model, which allows for the derivation of a counterfactual scenario. In this framework it becomes possible to evaluate, using this structural model, what would have happened if the mergers had not occurred. We find that these mergers have contributed to a decrease in loan interest rates larger than what could have been anticipated. The flow of credit to non financial firms was larger than what was suggested by the combination of the pre-merger equilibrium with the post-merger environment. In contrast, the flow of loans to households was lower than expected, even though the loans granted to this sector have recorded a significant growth during the period analysed.

1. INTRODUCTION

During the last decades there was a global consolidation trend in the banking system (Boot, 1999, Berger *et al.*, 2004, Uhde and Heimeshoff, 2009). In Portugal, the increase in bank concentration was specially marked in the year 2000. In that year, several mergers and acquisitions took place, involving four out of the seven largest banking groups operating at that time (including one large foreign bank). The magnitude of these mergers and acquisitions led to profound changes in the structure of the Portuguese banking system, with implications on the equilibrium in credit markets.

In this article, we analyze ex-post the impact of this merger wave in the Portuguese banking system, using two different methodologies. One of the most common approaches in the literature is to estimate the differential impact of mergers. This approach relies essentially on the comparison of several relevant variables before and after the mergers. However, this methodology suffers from serious limitations, as it ignores endogenous changes in market structure in the post-merger equilibrium in the banking system. In a recent paper, Barros *et al.* (2010) propose a new methodology to overcome these methodological limitations. By relying on a structural model of the credit market, this new methodology allows for a

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** Banco de Portugal, Economic Research Department and ISEG-UTL.

*** NOVA School of Business and Economics.

**** Universitat Pompeu Fabra and University of Haifa.

***** This work was initiated when Nuno was working at the Banco de Portugal and Universidade Nova de Lisboa.

counterfactual analysis of mergers, combining the pre-merger equilibrium setting with characteristics of the post-merger environment, while accounting for endogenously propagated changes in market structure. Using this procedure, it becomes possible to estimate loan flows and interest rates that would be observed if the pre-merger equilibrium was not altered, *i.e.*, if mergers had not occurred. In this article we apply the methodology presented in Barros *et al.* (2010) to the merger wave that occurred in the Portuguese banking system in 2000. Our impact assessment focuses on loan flows and loan interest rates, distinguishing the impact on households and on non-financial corporations.

We find important differences between the impact of bank mergers on loans granted to households and to firms, as we observe that mergers seem to have increased the amount of credit granted to firms and decreased the availability of loans to households, when compared to a counterfactual scenario. All in all, households may have faced some constraints in access to credit after the merger, even though loans to households recorded robust growth rates during this period. On the contrary, loans granted to firms seem to have surpassed by a large extent what could have been expected before the mergers. Moreover, the merger wave induced a stronger decrease in interest rates than what could have been foreseen, thus benefiting customers.

This article proceeds as follows. In section 2 we briefly review the related literature on the assessment of the impact of bank mergers and in section 3 we describe the datasets used for the empirical analysis. In section 4 we present an analysis of changes in the structure of the Portuguese and European banking system. In section 5 we briefly describe the counterfactual methodology proposed by Barros *et al.* (2010) and in section 6 we present our main results on the impact of the merger wave on Portuguese credit markets. Section 7 summarizes our main findings.

2. LITERATURE REVIEW

There is a large literature on the gains banks obtain from merging. For instance, Focarelli *et al.* (2002) find that mergers increase return on equity, but they also lead to a rise in staff costs. In turn, they find that acquisitions generate a long-term reduction in lending, mainly for small firms, and a permanent decrease in bad quality loans, which positively affects long-run profitability. Focusing on European mergers, Altunbas and Marqués (2008) find that improvements in banks' performance subsequent to mergers are more significant if there are strategic similarities between the merging banks. Mergers and acquisitions also generate important changes in market structure and competition, as discussed in Berger *et al.* (2004), Cerasi *et al.* (2010), Craig and Santos (1997) or in Gowrisankaran and Holmes (2004). Some authors also find that mergers may enhance cost reduction and improve resource allocation. For instance, Carbó Valverde and Humphrey (2004) argue that mergers should reduce costs faced by banks, raise their return on assets and improve general resource utilization. They also find that a merger is more likely to be successful if it is large (scale effect) and also if it is initiated by a bank that has been previously involved in a merger (learning effect). Moreover, mergers may generate informational gains, which improve banks' screening abilities and customer discrimination (see, for instance, Hauswald and Marquez, 2006, or Panetta *et al.*, 2009).

Furthermore, bank mergers may have important implications for financial stability, as they lead to changes in market power, concentration and competition. Many authors consider that there is trade-off between competition and financial stability, which may warrant the intervention of banking supervisors and competition authorities in some cases. Chan *et al.* (1986) show that more competition in banking markets implies an erosion of the surplus banks can obtain by screening borrowers' quality. These reduced incentives for adequate screening lead necessarily to an overall deterioration of the quality of banks' loan portfolios. Further theoretical evidence on the trade-off between market power and bank risk is presented by Hellman *et al.* (2000) and Repullo (2004). The main argument of this line of research is that market power is directly related to banks' franchise value, thus limiting the incentives for risk-

taking. Empirically, Beck *et al.* (2006) find that banking crisis are less likely when the banking system is more concentrated. Craig and Santos (1997) also show that consolidation in the banking industry in the US has allowed for increased risk diversification, thus decreasing individual bank risk. However, the authors note that this decrease in the risk of the banking system may be partly offset by an increase of the moral hazard associated with the too-big-to-fail problem. Indeed, if banks believe that they are likely to be bailed out in case of distress, they may have incentives to take on excessive risk. Jiménez *et al.* (2007) also obtain empirical evidence that supports this trade-off perspective. These authors find a negative relationship between Spanish banks' market power in the loan market and banks' risk-taking, measured as the ratio of non-performing commercial loans.

However, some authors have disputed this traditional "competition-fragility" view by presenting an alternative "competition-stability" theory, as discussed by Berger *et al.* (2009). For instance, Boyd and De Nicoló (2005) investigate the theoretical relationship between bank competition and risk-taking and find several limitations in the competition-fragility models. According to these authors, these models fail to identify important risk-incentive mechanisms that encourage banks to take on more risk when markets become more concentrated. More specifically, when there is less competition banks may extract more rents from customers, charging higher interest rates, which in turn imply also more risk-taking by borrowers and higher bankruptcy rates. Allen and Gale (2004), Carletti and Hartmann (2002) and Carletti *et al.* (2007) also present theoretical arguments to challenge the traditional competition-fragility view, showing that bank competition may sometimes promote financial stability. In addition, Uhde and Heimeshoff (2009) provide empirical evidence on the negative effect of bank concentration on banks' financial soundness, using data for European banks between 1997 and 2005.

All in all, the interactions between bank competition and financial stability are complex and multi-faceted, as discussed by Allen and Gale (2004). In a recent paper, Berger *et al.* (2009) show empirically that the two views described above are not necessarily incompatible. Their results, based on bank data for 23 developed economies, suggest that banks with more market power are generally less exposed to overall risk (which is consistent with the competition-fragility view), but they also find that market power increases the risk of the loan portfolio (thus also supporting in part the competition-stability perspective).

It is also important to assess the impact of bank mergers on customers. Several authors conclude that bank mergers may negatively affect borrowers, most notably if they are small and medium size firms, dependent on bank funding and with a limited number of bank relationships. For instance, Bonaccorsi di Patti and Gobbi (2007) find that, for a sample of Italian firms, bank mergers have a negative effect on credit, particularly if the lending relationship comes to an end after the merger, even though this effect should persist only during the three years after the merger. However, this negative effect is not sufficient to generate a negative impact on firms' investment or cash-flow sensitivity. Other authors find mixed evidence regarding the impact of bank mergers. Also using a sample of Italian firms, Sapienza (2002) concludes that in-market mergers benefit borrowers if these mergers involve banks with limited market power. However, as the market share of the acquired bank increases, the efficiency gains are offset by an increase in market power, which may imply a decrease in loan supply, especially to small borrowers. In another study, Scott and Dunkelberg (2003) analyze the results of a survey on US firms and find that bank mergers do not affect loan supply or interest rates, even though there is some deterioration in non-price loan terms, such as fees for specific services. Degryse *et al.* (2010) find that the impact of a bank merger is more negative for smaller borrowers and for single relationship borrowers. Moreover, target bank borrowers should be more harmed by the merger than borrowers of the acquiring bank. Finally, Karceski, *et al.* (2005) find that mergers may have impacts on borrowers beyond credit availability and interest rates. These authors show that mergers may in fact have important consequences on firm value, observing that borrowers of the acquiring banks usually benefit from the mergers, whereas firms that borrow from the target bank suffer an opposite impact.

There is less work done on the impact of bank mergers on depositors. There is some empirical evidence for Italian firms which suggests that bank mergers may have positive consequences for depositors in the long-run, even though there may be some negative effects in the short run (Focarelli and Panetta, 2003). However, Craig and Dinger (2009), using US data, obtain a different result, given that they do not observe any positive long-term effect of mergers on deposit interest rates. Their results are consistent with previous work done by Prager and Hannan (1998).

3. DATA

The empirical analysis of merger impact in the Portuguese banking system relies on three different data sources.

First, most of the information comes from the Monetary and Financial Statistics of Banco de Portugal. Using bank-level data, we are able to use unique interest rate and credit data, which allows distinguishing between the household and the corporate sectors. The Monetary and Financial Statistics are a monthly mandatory survey involving all financial institutions operating in the country and including information on end-of-period stocks and flows of credit granted to households and to non-financial corporations.[1] Data on interest rates are based on the flows of new credit granted.

The second dataset includes information on the branches' location. The data are collected by the Prudential Supervision Department of Banco de Portugal. Whenever a bank establishes a branch, it is required to report this event to the supervisor, as well as when there is a branch change of address, closing or any other major change.

Finally, the third database includes regional characteristics, more precisely quarterly demographic characteristics by district in Portugal, collected by Statistics Portugal.

The full dataset consists of quarterly data from the first quarter of 1995 to the third quarter of 2002 and each observation corresponds to a bank in each quarter.

4. MERGERS IN THE PORTUGUESE BANKING SYSTEM

During the last two decades, consolidation in the banking system was an important trend globally (Boot, 1999, Berger *et al.*, 2004, Uhde and Heimeshoff, 2009). Banks became larger by acquiring and/or merging with other banks, both domestically and internationally. In the European Union, this trend was supported in part by the increasing financial and economic integration among Member States. In particular, the enlargement of the European Union to Central and Eastern European countries offered some banking groups attractive opportunities for the expansion of their activities, even if some barriers to further consolidation in Europe may still exist, as discussed by Berger *et al.* (2001).

The consolidation trend in the European banking system is illustrated in charts 1 and 2. Both the share of the 5 largest credit institutions and the Herfindahl index for total assets of credit institutions show an increasing trend during the last decade.[2] The number of branches per 1000 inhabitants decreased significantly between 1997 and 2005, though some reversion in this trend was observed in the more recent years (Chart 3).

The total number of deals related to mergers and acquisitions of credit institutions in the European Union was remarkably large immediately after the creation of the euro area (Chart 4), having decreased since

1 For further details on the Monetary and Financial Statistics, please see http://www.bportugal.pt/en-US/Estatisticas/Dominios%20Estatisticos/Pages/EstatisticasMonetariaseFinanceiras.aspx.

2 These figures consider non-consolidated bank data. Possibly, consolidated figures would show a stronger concentration trend.

Chart 1

CR5 - SHARE OF THE 5 LARGEST CREDIT INSTITUTIONS IN TOTAL ASSETS | PER CENT

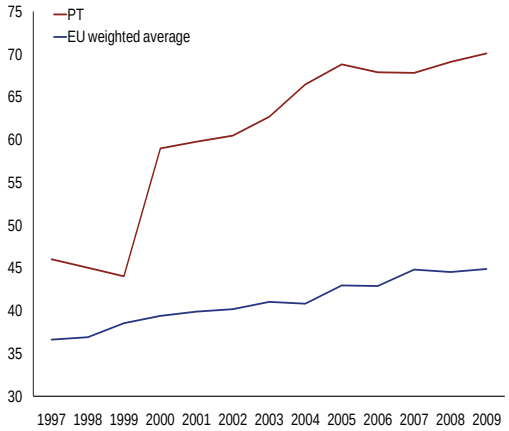
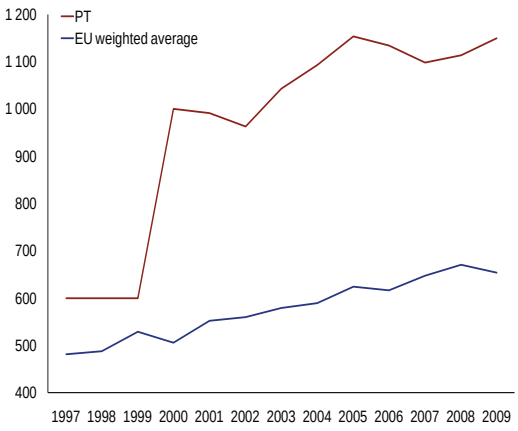


Chart 2

HERFINDAHL INDEX FOR TOTAL ASSETS OF CREDIT INSTITUTIONS



Sources: ECB (Structural analysis of the EU banking sector, November 2002, November 2003; EU Banking structures October 2005, September 2010) and authors' calculations.

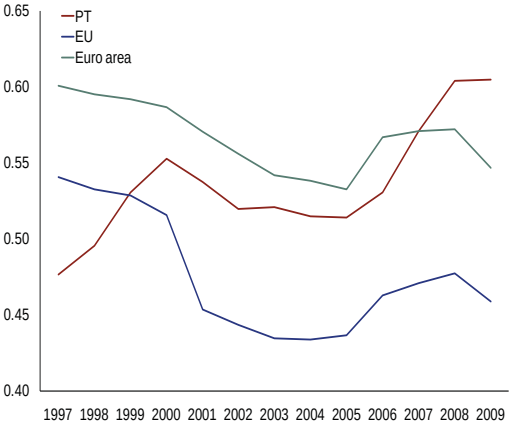
Note: Non-consolidated data.

2000 (ECB, 2007).[3] Most of these deals involved domestic credit institutions (Chart 5), thus contributing to explain the increase in concentration indicators observed during this period (Charts 1 and 2).

The number of deals was relatively large in many European countries during this period, as illustrated in chart 6. The absolute number of deals was very large in Germany, Italy, France, Spain and the UK. However, when evaluated as a percentage of GDP, the number of mergers and acquisition was more remarkable in Luxembourg and, to a lesser extent, in Italy, Greece and Portugal.

Chart 3

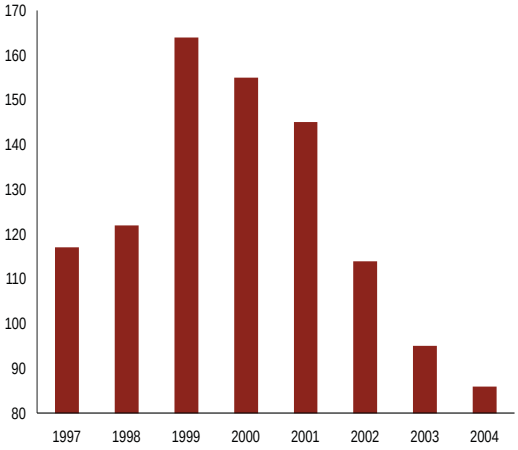
NUMBER OF BRANCHES OF CREDIT INSTITUTIONS PER 1000 INHABITANTS



Sources: ECB (Structural analysis of the EU banking sector, November 2002, November 2003; EU Banking structures October 2005, September 2010) and authors' calculations.

Chart 4

TOTAL NUMBER OF MERGERS AND ACQUISITIONS OF CREDIT INSTITUTIONS IN THE EUROPEAN UNION

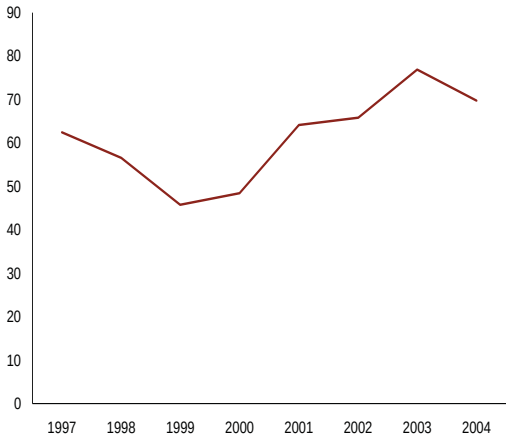


Sources: ECB (Structural analysis of the EU banking sector, November 2003; EU Banking structures October 2005) and authors' calculations.

3 Despite the decrease in the number of deals during the last decade, the value of the transactions increased between 2006 and 2008, after having decreased significantly between 2001 and 2005 (ECB, 2010).

Chart 5

PERCENTAGE OF DOMESTIC MERGERS AND ACQUISITIONS OF CREDIT INSTITUTIONS IN THE EUROPEAN UNION | PER CENT

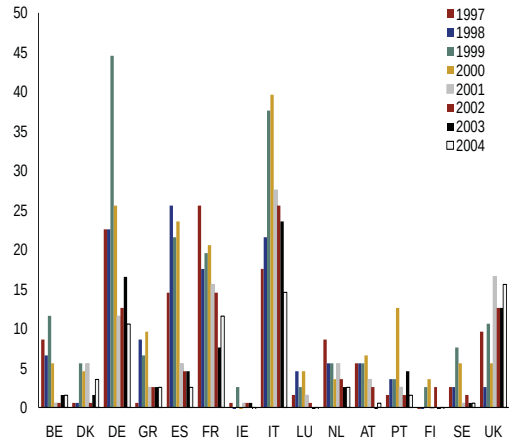


Sources: ECB (Structural analysis of the EU banking sector, November 2003; EU Banking structures October 2005) and authors' calculations.

In fact, the mergers in the Portuguese banking system during this period led to important changes in the structure of the banking market. The mergers and acquisitions involving Portuguese banks were specially concentrated in 2000. In this year, several of the largest banking groups were involved in concentration operations. In March 2000, the group Banco Pinto e Sotto Mayor (BPSM), which included the banks BPSM, Banco Totta e Sotto Mayor Inv (BTSM Inv), Banco Totta e Açores (BTA) and Crédito Predial Português (CPP), was extinguished. The bank BPSM was bought by Banco Comercial Português (BCP). At the same time, BTSM Inv was acquired by Caixa Geral de Depósitos (CGD) and CPP was acquired by BTA. Later in the year, the Spanish banking group Santander acquired BTA. These operations directly involved four out of the seven major financial groups in that period, thus generating profound changes in the structure of the Portuguese banking market. The magnitude of these changes is clearly illustrated in charts 1 and 2, where a very significant increase in concentration in the Portuguese banking system is observed. Despite this increase, chart 7 shows that the Portuguese banking system is still not highly concentrated compared to other European countries.

Chart 6

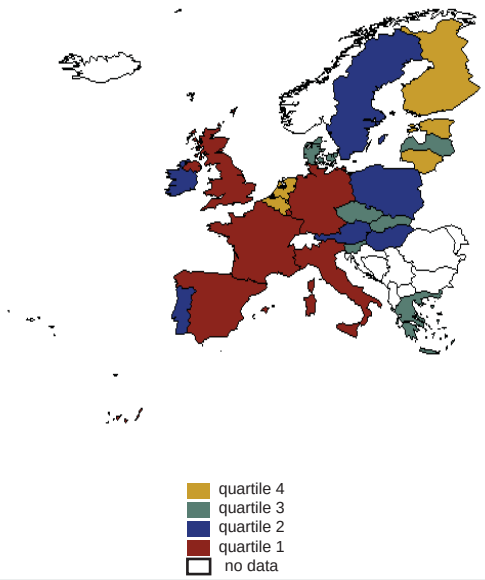
TOTAL NUMBER OF MERGERS AND ACQUISITIONS OF CREDIT INSTITUTIONS



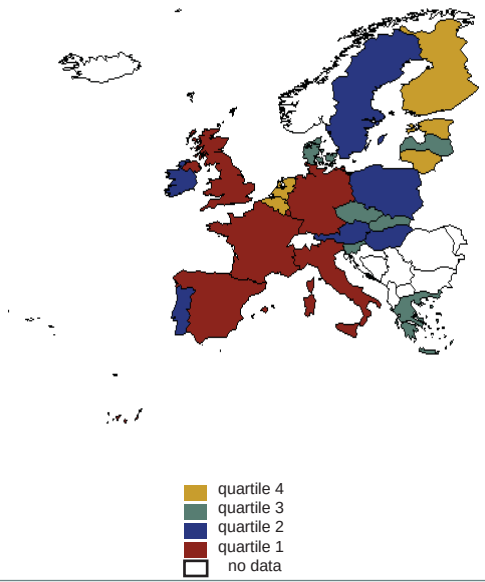
Sources: ECB (Structural analysis of the EU banking sector, November 2003; EU Banking structures October 2005) and authors' calculations.

Chart 7

SHARE OF THE FIVE LARGEST FINANCIAL INSTITUTIONS 2002



HERFINDAHL INDEX 2002



Sources: ECB (Structural analysis of the EU banking sector, November 2003) and authors' calculations.

Note: The colour codes refer to the four quartiles of the distributions of the share of the 5 largest financial institutions (left) and of the Herfindahl index for total assets of credit institutions (right).

The available evidence suggests that the significant changes that occurred in 2000 may have had important consequences in the credit market, namely on credit granted, interest rates charged and on the strategic effects among the financial players.

In table 1 we present some descriptive statistics to characterize the Portuguese banking system during the period analyzed (1995-2002).[4]

Overall, there are 71 banks in the dataset that are in operation for at least one quarter during the sample period. Banks are grouped in 8 major financial groups: we consider the seven most important financial groups that include 26 banks and one additional group including the remaining banks in the sample[5]. Four of these banking groups were directly involved in the 2000 merger wave.

Table 1 presents the summary statistics of our sample for the stock of credit, flows and other variables for three different groups of banks: i) the four large banking groups involved in the merger wave, ii) the three large banking groups not involved in the mergers, and iii) the remaining banks that were not involved in the merger wave. The average credit market share of a bank belonging to the group of banks engaged in mergers is 3.4 percent, while the large banks that do not belong to this group have on average 6.7 percent of the total stock of credit. In turn, the smaller banks not involved in mergers have only, on average, 0.6 percent of the credit market. This last evidence highlights the importance of treating these banks separately and, hence, they will be excluded from regression analysis.

4 A more detailed analysis of the Portuguese banking system during this period may be found in Antão *et al*. (2009).

5 As shown by Park and Pennacchi (2009), bank mergers affect differently large and small banks, hence justifying analyzing them separately.

Table 1

SUMMARY STATISTICS

	Banks involved in mergers					Large banks not involved in mergers					Other banks not involved in mergers				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Stock of credit															
Total stock of credit	323	2751	5134	1.5	31866	232	5422	7270	0.04	37014	791	419	580	0.24	3268
Number of branches	323	175	249	1	1312	232	242	229	1	786	791	26	44	1	217
Market share (total credit)	323	3.4	4	0.0	26.1	232	6.7	8	0.0	27.4	791	0.6	1	0.0	3.9
Flow of credit															
Total credit flow	323	2268	6064	0.2	39776	232	1903	2866	0	16420	791	314	555	0	3514
Credit flow (households)	323	318	761	0	5769	232	401	567	0	2750	791	41	78	0	437
Credit flow (corporate sector)	323	1950	5335	0	35655	232	1502	2341	0	13812	791	273	496	0	3116
Interest rates (%)															
Interest rate	323	11.1	5	3.2	25.7	232	9.2	4	3.8	20.0	791	8.5	4	2.6	23.6
Interest rate (household credit)	287	13.2	5	3.2	25.7	213	10.4	4	3.2	20.0	622	10.2	5	1.5	28.0
Interest rate (corporate sector credit)	264	9.9	4	3.1	23.5	226	9.3	4	3.8	18.8	736	7.9	3	2.6	22.3
Interbank market rate	323	5.2	2	2.4	9.1	232	5.0	2	2.4	9.1	791	4.9	2	2.4	9.1
Bank specific and demographic variables															
ROA	323	0.003	0.0	-0.1	0.03	232	0.003	0.0	-0.1	0.02	791	0.001	0.0	-0.3	0.04
LC	323	0.3	0.3	0.1	1.0	232	0.3	0.3	0.1	1.0	791	0.5	0.3	0.1	1.0
POP	323	14.0	3.8	9.4	21.4	232	13.0	3.7	2.4	21.4	791	15.0	5.1	2.5	21.4

Sources: *INE*, Banco de Portugal and authors' calculations.

Notes: The group of financial institutions directly involved in the merger includes institutions belonging to financial groups that have acquired or sold a financial institution to a different financial group in 2000. All credit values are in Eur million. Market shares are computed by taking into account the total outstanding amount of credit and are displayed as percentages. Interest rates are annualized and refer to new loans granted in each quarter. ROA is the return on assets of each bank, LC is a measure of local competition and POP is a measure of the importance of each market to bank i in period t.

The average interest rate on the total credit flow charged by the banks involved in mergers is 11.1 percent (9.2 percent for the other large banks and 8.5 per cent for the smaller banks). The household market experiences higher interest rates (13.2, 10.4 and 10.2 percent for the groups of banks under analysis) than the corporate sector (9.9, 9.3 and 7.9 percent, respectively).[6]

These statistics refer to the entire sample period. We will analyze how the merger wave affected credit flows and interest rates, both for households and for firms.

5. A STRUCTURAL MODEL OF THE BANKING SYSTEM

In a recent paper, Barros *et al.* (2010) present a new methodology to assess the impact of mergers in banking. This methodology is based on a structural model of the credit market. Using this structural model, it is possible to derive a counterfactual analysis of bank mergers, by combining the pre-merger equilibrium setting with characteristics of the post-merger environment, while simultaneously accounting for endogenously propagated changes in market structure. This methodology allows to estimate loan flows and interest rates that would be observed if the pre-merger equilibrium was not altered, *i.e.*, if mergers had not occurred. It becomes possible to obtain estimates of the impact of bank mergers accounting for the effects associated with endogenous changes in conduct and market structure after mergers have taken place. These effects are usually ignored in the assessment of merger impact and can lead to a significant bias in the results obtained. Moreover, this methodology allows disentangling the effect of changes in the macroeconomic and financial environment from endogenous changes in market structure resulting from the mergers.

In this section, we briefly present the anatomy of the structural model of equilibrium in the banking system (further details may be found in Barros *et al.*, 2010).

We consider that the loan demand function in credit markets is:

$$\ln L_{it} = \alpha_0 + \alpha_i + \alpha_1 \ln r_t + \alpha_2 \ln Z_t + \phi_1 \ln B_{it} + \phi_2 \ln B_{-it} + \phi_3 \ln r_{it} + \phi_4 \ln Pop_{it} + \phi_5 \ln LC_{it} \qquad (1)$$

L_{it} is the total loan demand directed at each bank i during a quarter t, measured by loan flows. This demand function encompasses two main components: economy-wide variables (all those denoted with a subscript t) and bank-level determinants (those with the subscript it). α_0 is a constant and α_i is a bank-specific fixed effect. The set of economy-wide variables includes the aggregate average interest rate on new loans granted in Portugal in each quarter, r_t, and a measure of overall macroeconomic conditions, Z_t (quarterly GDP). In turn, the bank-specific variables include the number of branches of a bank and of its rivals (B_{it} and B_{-it} respectively), the bank-specific interest rate on loans, r_{it}, and two measures of local competition, POP_{it} and LC_{it}. These two measures are defined as:

$$POP_{it} = \sum_{k=1...K} POP_{ikt} \frac{B_{ikt}}{B_{it}}$$

$$LC_{it} = \sum_{k=1...K} \left(\frac{B_{kt} - B_{ikt}}{B_{kt}} \frac{B_{ikt}}{B_{it}} \right)^2$$

6 Most of the banks in the sample operate in both the household and the corporate credit markets, even though some small banks display null credit flows in one of these segments in some quarters. All banks considered grant credit to households and only two small banks never grant credit to firms during the entire sample period. It should be noted that the household sector comprises both loans for consumption and other purposes and for house purchase. During the sample period, the estimated interest rate for the former was around 4 p.p. higher than for housing loans.

where the sum is performed for all the districts in the country. POP_{it} is a measure of the importance of each local market (district) to bank i in period t: the proportion of branches each bank has in local market k is weighted by the population in that market. Thus, banks that have a higher proportion of branches in more heavily populated areas will have, ceteris paribus, a higher demand for their loans. The variable LC_{it} is the sum of the squares of the district local market competition values and attempts to capture the intensity of competition. The basic element is the share of (branch) competition faced by bank i in market k. This is given by the share of rival banks in the total number of branches in local market k, weighted by the importance of local market k, branch-wise, to bank i. This index can accommodate the differences involved in having branches in markets where other banks have no branches relative to crowded markets.

In the model, the derivation of the banks' profit maximization function yields:

$$r_{it} = \frac{\phi_3}{1+\phi_3} c_{it} + \sum_{j \neq i} \lambda_{ij} \frac{\alpha_1}{-\phi_3 - 1} \frac{1}{n_t} \frac{L_{jt}}{L_{it}} (r_{jt} - c_{jt}) + \beta_i \qquad (2)$$

In this equation, j represents all rival banks and c_{it} are funding costs. Bank fixed-effects are represented by β_i. The strategic effects between bank i and its j rivals are captured by the group of parameters λ_{ij}. If $\lambda_{ij} = 1$, there is collusion, whereas if $\lambda_{ij} = 0$ banks maximize profits independently.

The equilibrium in credit markets is given by:

$$\begin{cases} \ln L_{it} = \alpha_0 + \alpha_i + \alpha_1 \ln r_t + \alpha_2 \ln Z_t + \phi_1 \ln B_{it} + \phi_2 \ln B_{-it} + \phi_3 \ln r_{it} + \\ \phi_4 \ln Pop_{it} + \phi_5 \ln LC_{it} + \varepsilon_{it} \\ r_{it} = \beta_0 + \beta_1 c_{it} + \beta_2 R\min_{it} + v_{it} \\ \beta_1 = \dfrac{\phi_3}{1+\phi_3} \\ R\min_{it} = Min_{r_{jt}} \left[\dfrac{1}{n_t} \dfrac{L_{jt}}{L_{it}} (r_{jt} - c_{jt}) \right] \end{cases} \qquad (3)$$

In order to simplify the empirical estimation, we have reduced the number of strategic effects λ_{ij} and considered the interaction of bank i with its main rival, which is defined to be the financial institution with the lowest interest rate during the quarter, $Rmin_{it}$.[7]

This system of equations is empirically estimated using a seemingly unrelated regression (SUR) model, which allows for cross-equations correlation of the residuals.

6. ESTIMATING THE IMPACT OF THE 2000 MERGER WAVE IN THE PORTUGUESE BANKING SYSTEM

6.1. What changed after the mergers?

In this section we analyze the impact of the 2000 merger wave on credit flows and interest rates. Furthermore, we also consider how the merger wave affected local branch competition and coordination moves in the banking industry.

7 We have tried different strategic effects and the results do not change significantly. For instance, we have considered (i) defining the main rival as the bank that has granted more credit during the quarter; (ii) the bank with the closest loan flow in each quarter; (iii) the interaction of the five main rivals; or (iv) the average of the interaction of the five main rivals.

In table 2, we begin by simply comparing credit flows, interest rates and concentration indicators before and after the merger wave. After the mergers, loan flows were higher than in the pre-merger period, both for households and firms. It is worth noting that this trend was stronger for the banks directly involved in the mergers, given that the remaining banks actually recorded some decrease in loan flows, especially in what concerns loans to households. Moreover, average loan flows are only statistically different before and after the mergers for those banks that were directly involved in this process. Comparing interest rates in the pre- and post- merger periods, we observe that there was a widespread decrease in interest rates after the mergers occurred, partly reflecting lower banks' funding costs arising from lower money market interest rates during this period, as well as from access to more varied funding sources due to the participation in the euro area. However, the data show that banks directly involved in the mergers decreased interest rates more aggressively than the other banks, narrowing their interest rate margins in order to attract more customers and, possibly, also reflecting efficiency and informational gains arising from the merger process (see, for example, Sapienza, 2002, Hauswald and Marquez, 2006, and Panetta *et al.*, 2009).

Table 2

ANALYSIS CREDIT FLOWS AND INTEREST RATES BEFORE AND AFTER THE MERGERS

	All banks				Banks directly involved in mergers				Banks not directly involved in mergers			
	Pre-merger period	Post-merger period	Diff		Observed in the pre-merger period	Observed in the post-merger period	Diff		Observed in the pre-merger period	Observed in the post-merger period	Diff	
	(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)	
Credit flows (ln)												
Total	5.76	5.81	0.05		5.50	5.76	0.26		6.16	5.88	-0.28	
Households	4.10	4.77	0.67	***	3.74	5.07	1.33	***	4.60	4.37	-0.23	
Firms	5.59	6.01	0.42	*	5.39	6.14	0.74	*	5.84	5.89	0.05	
Interest rates												
Total	11.46	8.20	-3.26	***	12.18	8.92	-3.26	***	10.39	7.30	-3.09	***
Households	13.31	9.37	-3.95	***	14.49	10.46	-4.03	***	11.68	7.96	-3.72	***
Firms	11.03	6.83	-4.20	***	11.30	6.58	-4.72	***	10.68	7.07	-3.62	***

Sources: Banco de Portugal and authors' calculations.

Notes: The pre-merger period comprehends the 1995-1999 period, whereas the post-merger period goes from 2000 to 2002. The group of financial institutions directly involved in the merger includes institutions belonging to financial groups that have acquired or sold a financial institution to a different financial group in 2000. The interest rates refer to the new loans granted in each quarter. Asterisks refer to mean comparison tests between the pre- and post-merger variables. * significant at 10%; ** significant at 5%; *** signficant at 1%.

However, this simple analysis is necessarily incomplete, as many factors may be driving the differences in credit and interest rates in these two periods. In this respect, a more robust identification strategy is to use the structural model of the credit market outlined in the previous section to study the differential impact of the merger wave. More precisely, we can estimate the following modified empirical version of (3):

$$\begin{cases} \ln L_{it} = \alpha_0 + \alpha_i + \alpha_{01} AFTER + \alpha_1 \ln r_t + \alpha_2 \ln Z_t + \phi_1 \ln B_{it} + \phi_2 \ln B_{-it} + \phi_3 \ln r_{it} + \\ \phi_4 \ln Pop_{it} + \phi_5 \ln LC_{it} + \phi_{51} \ln LC_{it} * AFTER + \varepsilon_{it} \\ \\ r_{it} = \beta_0 + \beta_{01} AFTER + \beta_1 c_{it} + \beta_2 R\min_{it} + \beta_3 R\min_{it} * AFTER + v_{it} \\ \\ \beta_1 = \dfrac{\phi_3}{1+\phi_3} \\ R\min_{it} = Min_{r_{jt}} \left[\dfrac{1}{n_t} \dfrac{L_{jt}}{L_{it}} (r_{jt} - c_{jt}) \right] \end{cases} \quad (4)$$

In this model, the coefficient α_{01} captures eventual changes in the level of the credit flow after the merger wave and Φ_{51} considers the difference in the impact of the local branch competition on the quarterly credit flow following the 2000 merger with respect to the impact during the pre-merger period. The variable $AFTER$ is a binary variable that takes the value 1 when an observation refers to a quarter in 2000 or after. The results for the differential impact of the merger wave are presented in table 3.

In this table, columns (1)-(2) present the analysis for the total credit flow (household plus corporate credit, *i.e.*, non-financial private sector) and columns (3)-(4) and (5)-(6) present the results for the household and corporate sectors, respectively. It should be noted that, in this setting, we are able to differentiate banking output into household and firm loans without making any assumptions regarding their complementarity or substitutability, given that these are two different and independent markets. This implies null cross-elasticities of demand between these markets, given that, by definition, customers cannot switch between them. Thus, specifying linear demand functions should not inflict problems that would exist in markets where these cross-elasticities vary in response to different strategies.[8] As mentioned before, the system of equations (4) is estimated using a seemingly unrelated (SUR) model, which allows for cross-equations correlation of the residuals and takes into account the constraint included in the structural model. All regressions are estimated using banks' fixed effects and robust standard errors.

Looking at the results for the aggregated credit flows, in columns (1) and (2), we observe that the total number of branches is positively and significantly related to the logarithm of total credit granted, indicating that local branching arrangements are an important factor in liquidity provision.[9] In addition, the interest rate charged by the bank is negatively related to the total credit granted, as would be expected.[10] Furthermore, the interest rate charged by each bank, r_{it}, is strongly and positively related to banks' funding costs, c_{it} (which is a measure of weighted funding costs, taking into account deposit and interbank funding).

Although columns (1) and (2) reveal consistent estimates of the determinants of the credit and interest rates charged by the bank, the analysis for the aggregate credit flows smoothes important idiosyncratic characteristics of the determinants of the household and corporate sectors credit markets, which are analyzed in columns (3)-(4) and (5)-(6), respectively. The distinction across these institutional sectors highlights important differences in these markets, thus justifying a disaggregate specification rather than treating the credit market as homogeneous.

We observe that the banks' own number of branches positively influences credit granted, both to households and to firms (the estimated coefficients are 1.05 and 1.17, respectively). In turn, the number of branches of the remaining banks is not significantly correlated with credit granted to households, as illustrated in column (3), while it has a negative and significant impact on credit supplied to the corporate sector.

The first row of the estimated coefficients in table 3 shows the results for the variable $AFTER$. For the whole non-financial private sector (column (1)), credit flows increased after the merger wave and interest rates decreased significantly. However, there are important differences in the merger impact on the household and corporate sectors. In fact, the negative coefficient for the dummy $AFTER$ in column (3) reveals that the quarterly credit flow decreased after the mergers for the household sector, despite the decrease in interest rates (column (4)). This suggests that there were important changes in market

8 Berg and Kim (1998) empirically document such separability in the Norwegian market and present a discussion on cross-market interactions when banks produce multiple outputs.

9 In a recent paper, Corvoisier and Gropp (2009) argue that the widespread use of web-based banking platforms should have decreased sunk costs and increased contestability in retail banking, as establishing branches became less important. Nevertheless, the authors find that even though this hypothesis may be true for time and saving deposits, it does not hold for small business loans, where establishing a branching network with local connections is still important.

10 In the table, we omit the *t*-stats for this coefficient in columns (1), (3) and (5), as this coefficient is determined by the constraint in the system.

Table 3

ANALYSIS OF THE DIFFERENTIAL IMPACT OF THE MERGER WAVE

	Fluxos de crédito totais		Households		Sociedades não financeiras	
	(1)	(2)	(3)	(4)	(5)	(6)
	System of equations		System of equations		System of equations	
	ln(credit)	r_{it}	ln(credit)	r_{it}	ln(credit)	r_{it}
$AFTER$	0.343 **	-1.628 ***	-0.471 ***	-2.003 ***	0.971 ***	-1.939 ***
	(2.09)	-(8.07)	-(3.01)	-(8.22)	(4.48)	-(8.40)
ln (number of branches)	0.974 ***		1.052 ***		1.168 **	
	(3.07)		(2.89)		(2.50)	
ln (number of branches other banks)	-0.745		0.774		-3.337 ***	
	-(1.05)		(1.13)		-(3.56)	
$ln(r_t)$	-0.133		0.343		-0.545	
	-(0.38)		(0.81)		-(1.04)	
$ln(r_{it})$	-0.310 ***		-1.064 ***		-1.268 ***	
	-		-		-	
GDP	0.041		0.130 ***		-0.045	
	(1.37)		(4.01)		-(0.91)	
POP	0.130 *		-0.023		-0.213 *	
	(1.65)		-(0.21)		-(1.87)	
LC	6.066 ***		6.559 **		17.389 ***	
	(2.63)		(2.31)		(5.46)	
$LC*AFTER$	-1.021 ***		0.462		-2.289 ***	
	-(4.02)		(1.47)		-(5.21)	
c_{it}		1.046 ***		1.036 ***		1.068 ***
		(22.71)		(19.30)		(20.68)
$Rmin$		-15.475		-1.147		0.622 ***
		-(1.34)		-(1.01)		(4.47)
$Rmin*AFTER$		4.953		-6.171		-0.491 ***
		(0.12)		-(0.42)		-(3.49)
constant	4.598	6.102 ***	-9.142	7.247 ***	32.409 ***	6.202 ***
	(0.68)	(9.12)	-(1.36)	(9.55)	(3.53)	(8.64)
Lambda (λ)		-80.6		-0.2		-0.3
$H0 = \lambda = 0 \ \ [Prob > \chi 2]$		0.71		0.53		0.31
$H0 = \lambda = 1 \ \ [Prob > \chi 2]$		0.71		0.00		0.00
Lambda $*AFTER$ (λ_{after})		25.8		-1.2		0.2
$H0 = \lambda = 0 \ \ [Prob > \chi 2]$		0.91		0.71		0.32
$H0 = \lambda = 1 \ \ [Prob > \chi 2]$		0.91		0.49		0.00
Observations	562	562	507	507	496	496

Sources: Banco de Portugal and authors' calculations.

Notes: All regressions include banks' fixed effects and robust standard errors. Robust t statistics are presented in parentheses. * significant at 10%; ** significant at 5%; *** signficant at 1%. The estimations are performed for quarterly data during the 1995-2002 period. The estimation considers the constraint included in the system using a seemingly unrelated (SUR) model. $AFTER$ is a binary variable that takes the value one if the observation is on or after 2000. The interest rates refer to the new loans granted in each quarter. LC is a measure of local competition and POP is a measure of the importance of each market to bank i in period t. C_{it} is a measure of weighted funding costs, taking into account deposits and interbank funding. $Rmin$ is a variable that measures the strategic interaction between banks, being defined as $Rmin$ = (1/nbanks) * L_{jt} / L_{it} * (r_{jt} - c_{jt}), where L_{jt} and r_{jt} are, respectively, the loan flow and the interest rates of each banks' rival, defined as that with the lowest interest rate in that quarter, in each market segment. The t statistics for the coefficient associated with $ln(r_{it})$ in columns (1), (3) and (5) are omitted, as this coefficient is determined by a constraint in the model. The lower number of observations in the regressions for households and firms is due to the fact that some small banks show null credit flows in one of these market segments in some quarters (two small banks never grant credit to firms during the entire sample period). λ reflects the effect of the rival banks on the profit maximization function of each bank and is derived from a combination of the estimated coefficients, resulting from the model.

equilibrium after the mergers, given that a pure shift along the demand curve would imply a positive effect on credit due to the decrease in interest rates.

During the sample period, separate bank-level data on new loans and interest rates granted for house purchase and for consumption are not available. However, given the potentially relevant strategic differences in these two segments of the credit market, we conducted an additional estimation exercise to obtain approximate results for these two segments.[11] Using these proxies, we find that the decrease of loan flows and interest rates in the household sector after the merger was possibly much more pronounced in loans for consumption and other purposes.

In turn, for the corporate sector, credit granted increased after the merger and the interest rate charged decreased, as shown in columns (5) and (6). Post-merger equilibrium loan rates decrease when the merger induces large cost advantages relative to the increase in banks' market power, as shown by Carletti *et al.* (2007). Our results are consistent with Fonseca and Normann (2008), who argue that even though a merger involving the largest firm in a market creates a more asymmetric market structure, asymmetric markets exhibit lower prices than symmetric markets with the same number of firms.[12]

Looking at the effect on local branch competition, LC_{it}, we find that the merger impact was more significant for the corporate sector. In this credit market, we find that the merger leads to a decrease in the impact of local competition on the credit flow. Hence, the positive impact of local bank competition on credit granted to firms becomes slightly smaller (though still positive and large) after the merger wave.

The evidence on strategic behaviour, measured by the coordination parameter λ, suggests that there is no collusion between banks. The statistical tests on these parameters show that we can reject the hypothesis of collusion in the household credit market for the whole period, though that conclusion does not hold for the post-merger period. In turn, in the corporate loan market we always reject the existence of full coordination moves between banks, even though λ increased somewhat after the merger wave. These results are consistent with previous evidence obtained by Berg and Kim (1998), who argue that the mobility of customers in the corporate market is stronger than in other markets, thus generating more competitive behaviours by banks. More recently, Degryse *et al.* (2010) show that firms may benefit from switching banks after mergers occur, which is related to banks' competitive strategies.

6.2. Limitations of the differential analysis and the proposal of a new methodology

The previous analysis computes a differential effect of specific variables and assumes that all other interactions remain constant. This is one of the most common approaches in the literature to estimate the impact of bank mergers. However, this methodology does not fully take into account the structural changes that should have occurred in credit markets after the merger wave. Given the magnitude and extension of the mergers, the way banks (and their customers) interact should change substantially after large mergers. In Barros *et al.* (2010) a new methodology is proposed to overcome the limitations of the differential analysis. Using the structural model briefly described in section 5, it becomes possible to estimate a counterfactual scenario for the post-merger period, thus going beyond the simple (and

11 To do that, we use information on the share of loan flows granted for these two purposes to obtain proxies for the new credit granted (however, whereas in the rest of the article loan flows refer to new credit granted, here we estimate this share using the difference in the amount of loans outstanding at t and t-1; hence, these loan flows reflect new credit granted deducted from amortizations of outstanding loans). Moreover, for interest rates we used the aggregate difference between rates on outstanding loans in these two segments of loans to households to obtain bank-level proxies.

12 In order to confirm the validity and strength of these differential impacts, we tested for the existence of a structural break after the merger wave, using a Chow test. In all the tests performed we reject the null hypothesis of structural stability of the parameters.

insufficient) comparison of variables before and after mergers occur, which is usually performed for the assessment of merger impact.

The estimation of counterfactuals to assess the impacts of a merger may be considered an important policy tool. For instance, Ivaldi and Verboven (2005) emphasize that the evaluation of a merger from a policy perspective should not be based solely on a static comparative analysis, but should also consider dynamic effects and alternative merger scenarios. Berry and Pakes (1993) also argue that static models of equilibrium do not take into account the long-run reactions of merging and non-merging firms, thus generating misleading results. In an application to the airline industry, Peters (2006) demonstrates the importance of designing a counterfactual analysis to evaluate the impact of mergers, but is silent regarding the possibility of collusion or strategic interactions between firms. Berger *et al.* (1998) find empirical evidence that supports the view that the dynamic effects of mergers may generate results different from those obtained using static analysis. The authors identify a decrease in lending to small business after a merger, even though this static effect is largely offset by dynamic effects associated with changes in the focus of the merging banks or with the reaction of other banks. Nevertheless, these authors do not consider local changes induced by mergers, neither do they compare the impact on different institutional sectors.

In a few words, the counterfactual methodology proposed in Barros *et al.* (2010) considers that a whole new scenario is created after the merger wave that influences all variables in the credit market. Under this scenario, the evaluation of the differences in strategic effects requires the comparison between the results for the post-merger period and the ones obtained from the estimation of the pre-merger equilibrium using the post-merger data (counterfactual). The main advantage is that it becomes possible to analyze the merger impact using the post-merger environment.

To construct the counterfactual for the empirical estimation we first estimate the model (3) for the 1995-1999 pre-merger period. We then use the pre-merger coefficient estimates of this model for the 2000-2002 data on exogenous variables to obtain the value of the estimated post-merger credit flows and interest rates charged by the bank. This means that these two estimated variables are the credit and interest rates in the post-merger period assuming the impact of the market environment, strategic effects and local market competition in the pre-merger period. Hence, we use the structural model of equilibrium in credit markets to analyze the impact of changes in market factors due to the merger wave. Using this methodology, we compare the interest rate and credit flows in the post-merger equilibrium setup with the value of these variables under a counterfactual equilibrium. This counterfactual equilibrium is estimated using the after-merger exogenous environment under the pre-merger market structure.

6.3. Main counterfactual results

In table 4 we present the main results of the counterfactual analysis of the 2000 merger wave in the Portuguese banking system. The first two columns show the observed credit flows before and after the merger wave (as in table 2), and column (3) displays the counterfactual estimates. As described above, these estimates result from predicting these two variables for the post-merger period, by taking into account the pre-merger equilibrium and the post-merger environment. Hence, variables such as money market interest rates, GDP or number of branches are considered in the post-merger period to obtain these estimates. We also present the results of mean comparison tests between the counterfactual estimates and the post-merger observed variables.

By comparing credit flows observed after the merger with the estimated post-merger flows, we conclude that aggregate loan flows would have increased even more if mergers would not have occurred, albeit the difference between the counterfactual and the actually observed loan flows is not statistically significant. However, our results also show that there are important differences between the evolution of loans to households and to firms. On the one hand, the model predicts a slowdown in credit granted to firms,

in striking contrast with the acceleration actually observed during this period. On the other hand, the model predicts that household credit could be significantly larger than what was actually observed.

To better understand these results, we used the proxies mentioned in section 6.1 to run the counterfactual exercise separately for estimates of loans and interest rates for house purchase and for consumption and other purposes. Though this analysis has several limitations, we find that the counterfactual results obtained for the household sector in table 4 should be mainly associated with the evolution of loans for consumption and other purposes, as the loan flows for house purchase in the counterfactual scenario are not statistically very different from those observed in the post-merger period. Indeed, the estimates performed suggest that loan flows in housing loans have increased slightly more after the mergers than what could have been predicted in the counterfactual.

The counterfactual estimates also suggest that interest rates would still decrease if no mergers had occurred. However, comparing these estimates to the post-merger observed values, we conclude that the observed decrease in interest rates was, by any means, larger than that predicted by the pre-merger equilibrium, even taking into account the developments in money market interest rates in the post-merger period.

All in all, this strong decrease in interest rates, which largely surpassed the counterfactual estimates in all the credit market segments, should be associated with an increase in credit granted. However, in table 4 we observe that this is not the case for loans to households, where loan flows observed after the mergers were actually lower than what was predicted by the counterfactual (though above those observed in the pre-merger period). As discussed before, this result was possibly mainly due to the evolution of loans for consumption and other purposes, as the flow of loans granted for house purchase was larger in reality than what was predicted by the counterfactual. Given that a pure shift along the demand curve would simply imply a positive effect on credit as a result of the decrease in interest rates, this outcome for household loans suggests that there were important changes in market equilibrium after the mergers, specially in loans for consumption: even though banks decreased interest rates aggressively in this segment, the loan demand was possibly not as strong as expected. Indeed, between end-1999 and early 2003 the annual growth rates of loans to households for consumption and other purposes decreased significantly, from around 30% to virtually null growth rates. This evolution occurred against a background of contraction in the consumption of durable goods.

In Barros *et al.* (2010) the counterfactual analysis is extended to also consider the possibility of ignoring changes in the branch network after the mergers, given that these should have had effects on the structure of the branch network and, most notably, on local bank competition. Hence, counterfactual values

Table 4

ANALYSIS OF CREDIT FLOWS AND INTEREST RATES IN DIFFERENT SCENARIOS | COUNTERFACTUAL

	Observed in the pre-merger period (1)	Observed in the post-merger period (2)	Counterfactual for the after-merger period (3)	
Credit flows (ln)				
Total	5.76	5.81	5.93	
Households	4.10	4.77	5.26	***
Firms	5.59	6.01	4.36	***
Interest rates				
Total	11.46	8.20	9.53	***
Households	13.31	9.37	11.08	***
Firms	11.03	6.83	8.92	***

Sources: Banco de Portugal and authors' calculations.

Notes: The estimations are performed for quarterly data during the 1995-2002 period. The pre-merger period comprehends the 1995-1999 period, whereas the post-merger period goes from 2000 to 2002. The interest rates refer to the new loans granted in each quarter. Column (3) presents the counterfactual estimates for the post-merger period, by taking into account the pre-merger equilibrium and the post-merger environment. Asterisks refer to mean comparison tests between the counterfactual and the observed post-merger variables. * significant at 10%; ** significant at 5%; *** signficant at 1%.

for credit and interest rates are also estimated by assuming that the branch network remains unchanged at pre-merger levels. Furthermore, two different groups of financial institutions are analyzed separately, more specifically the ones that are directly involved in the merger wave and those that are not directly involved in the merger wave. In addition, using the structural model we decompose the merger impacts into several different components, distinguishing between changes in the exogenous environment and changes in the branch network and market structure.

7. CONCLUDING REMARKS

In this paper we estimate the impact of a large merger wave in the Portuguese banking system using two different methodologies. First we conduct a differential analysis of the impact of the merger wave, in line with what is usually done in the literature. However, this analytical tool suffers from several important limitations, as it ignores endogenous changes in market structure in the post-merger equilibrium in the banking system. Second, to overcome those limitations, we analyze the impact of this merger wave using a structural model of the credit market, described in Barros *et al.* (2010), which allows for the estimation of a counterfactual scenario. With this methodology, we are able to compare loans flows and interest rates observed after the mergers with those that would have been observed if the mergers had not taken place.

Our main results show that the interest rates observed after the mergers were lower than what the counterfactual would suggest. This may reflect efficiency and informational gains resulting from the mergers and reflected into more competitive pricing. Furthermore, we find important differences between loans granted to households and to non-financial corporations: whereas loans granted to households were in fact lower than what would be suggested by the counterfactual, loans granted to firms actually recorded a stronger growth than what could have occurred if no mergers had taken place. All in all, households may have faced some constraints in access to credit after the merger, even though loans to households recorded robust growth rates during this period. On the contrary, loans granted to firms seem to have surpassed by a large extent the counterfactual estimates.

REFERENCES

Allen, F. and D. Gale (2004), "Competition and financial stability", *Journal of Money, Credit, and Banking*, 36, 453-480.

Altunbas, Y. and D. Marqués (2008), "Mergers and acquisitions and bank performance in Europe: The role of strategic similarities", *Journal of Economics and Business*, 60, 204-222.

Antão, P., M. Boucinha, L. Farinha, A. Lacerda, A.C. Leal and N. Ribeiro (2009), "Financial integration, financial structures and the decisions of households and firms", in Economics and Research Department *The Portuguese Economy in the Context of Economic, Financial and Monetary Integration*, Banco de Portugal, 415-545.

Barros, P.P., D. Bonfim, M. Kim and N. C. Martins (2010), "Counterfactual Analysis of Bank Mergers", Banco de Portugal *Working Paper* 5/2010.

Beck, T., A. Demirguc-Kunt, R. Levine (2006), "Bank concentration, competition, and crises: First results", *Journal of Banking and Finance*, 30, 1581-1603.

Berg, S. A. and M. Kim (1998), "Banks as multioutput oligopolies: An empirical evaluation of the retail and corporate banking markets", *Journal of Money, Credit and Banking*, 30 (2), 135-153.

Berger, A., S. D. Bonime, L. G. Goldberg and L. J. White (2004), "The dynamics of market entry: the effects of mergers and acquisitions on entry in the banking industry", *Journal of Business*, 77 (4), 797-834.

Berger, A., R. De Young and G. F. Udell (2001), "Efficiency barriers to the consolidation of the European financial services industry", *European Financial Management*, 7, 117-130.

Berger, A., L. Klapper and R. Turk-Ariss (2009), "Bank competition and financial stability", *Journal of Financial Services Research*, 35, 99-118.

Berger, A., A. Saunders, J. M. Scalise and G. F. Udell (1998), "The effects of bank mergers and acquisitions on small business lending", *Journal of Financial Economics*, 50, 187-229.

Berry, S. and A. Pakes (1993), "Some applications and limitations of recent advances in empirical industrial organization: merger analysis", *American Economic Review*, 83 (2), 247-252.

Bonaccorsi di Patti, E. and G. Gobbi (2007), "Winners or Losers? The effects of banking consolidation on corporate borrowers", *The Journal of Finance*, 62, 669-695.

Boot, A. (1999), "European lessons on consolidation in banking", *Journal of Banking and Finance*, 23, 609-613.

Boyd, J. and G. De Nicoló (2005), "The theory of bank risk taking and competition revisited", *Journal of Finance*, 60, 1329-1343.

Carbó Valverde, S. and D. B. Humphrey (2004), "Predicted and atual costs from individual bank mergers", *Journal of Economics and Business*, 56, 137-157.

Carletti, E. and P. Hartmann (2002), "Competition and stability: what's special about banking?", ECB *Working Paper* No. 146.

Carletti, E., P. Hartmann and G. Spagnolo (2007), "Bank mergers, competition, and liquidity", *Journal of Money, Credit and Banking*, 39 (5), 1067-1105.

Cerasi, V., B. Chizzolini and M. Ivaldi (2010), "The impact of mergers on the degree of competition in the banking industry", CEPR *Discussion Paper* No. DP 7618.

Chan, Y., S. Greenbaum and A. Thakor (1986), "Information reusability, competition and bank asset quality", *Journal of Banking and Finance*, 10, 243-253.

Corvoisier, S. and R. Gropp (2009), "Contestability, technology and banking", ZEW *Discussion Paper* No. 09-007.

Craig, B. and V. Dinger (2009), "Bank mergers and the dynamics of deposit interest rates", *Journal of Financial Services Research*, 36, 111-133.

Craig. B. and J. A. C. Santos (1997), "The Risk Effects of Bank Acquisitions", Federal Reserve Bank of Cleveland *Economic Review*, 33(2), 25-35.

Degryse, H., N. Masschelein and J. Mitchell (2010), "Staying, dropping or switching: the impacts of bank mergers on small firms", *Review of Financial Studies*, forthcoming.

ECB (2007), *EU Banking Structures*, October 2007.

ECB (2010), *EU Banking Structures*, September 2010.

Focarelli, D. and F. Panetta (2003), "Are mergers beneficial to consumers? Evidence from the market for bank deposits", *American Economic Review*, 93 (4), 1152-1172.

Focarelli, D., F. Panetta and C. Salleo (2002), "Why do banks merge?", *Journal of Money, Credit and Banking*, 34, 1047-1066.

Fonseca, M. A. and H. T. Normann (2008), "Mergers, asymmetries and collusion: experimental evidence", *The Economic Journal*, 118, 387-400.

Gowrisankaran, G. and T. J. Holmes (2004), "Mergers and the evolution of industry concentration: results from the dominant-firm model", RAND *Journal of Economics*, 35 (3), 1-22.

Hauswald, R. and R. Marquez (2006), "Competition and strategic information acquisition in credit markets", *Review of Financial Studies*, 19 (3), 967-1000.

Hellman, T., K. Murdock and J. Stiglitz (2000), "Liberalization, moral hazard in banking, and prudential regulation: are capital requirements enough?", *American Economic Review*, 90, 147-165.

Ivaldi, M. and F. Verboven (2005), "Quantifying the effects from horizontal mergers in European competition policy", *International Journal of Industrial Organization*, 23, 669-691.

Jiménez, G., J. Lopez and J. Saurina (2007), "How does competition impact bank risk-taking?", Federal Reserve Bank of San Francisco *Working Paper* 2007-23.

Karceski, J., S. Ongena, and D. C. Smith (2005), "The impact of bank consolidation on commercial borrower welfare", *Journal of Finance*, 60 (4), 2043-2082.

Panetta, F., F. Schivardi and M. Shum (2009), "Do mergers improve information? Evidence from the loan market", *Journal of Money, Credit and Banking*, 41 (4), 673-709.

Park, K. and G. Pennacchi (2009), "Harming depositors and helping borrowers: the disparate impact of bank consolidation", *Review of Financial Studies*, 22 (1), 1-40.

Peters, C. (2006), "Evaluating the performance of merger simulation: Evidence from the US airline industry", *Journal of Law and Economics*, 49, 627-649.

Prager, R. and T. Hannan (1998), "Do substantial horizontal mergers generate significant price effects? Evidence from the banking industry", *Journal of Industrial Economics*, 46 (4), 433-452.

Repullo, R. (2004), "Capital requirements, market power, and risk-taking in banking", *Journal of financial intermediation*, 13, 156-182.

Sapienza, P. (2002), "The effects of banking mergers on loan contracts", *The Journal of Finance*, 57 (1), 329-367.

Scott, J. A. and W. C. Dunkelberg (2003), "Bank mergers and small firm financing", *Journal of Money Credit and Banking*, 35 (6), 999-1017.

Uhde, A. and U. Heimeshoff (2009), "Consolidation in banking and financial stability in Europe: Empirical evidence", *Journal of Banking and Finance*, 33, 1299-1311.