Fiscal Consolidations and Banking Stability*

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Abstract

We empirically investigate the effects of fiscal policy on bank balance sheets, focusing on episodes of fiscal consolidation. To this aim, we employ a very large data set of individual banks' balance sheets, combined with a newly compiled data set on fiscal consolidations. We find that standard capital adequacy ratios such as the Tier-1 ratio tend to improve following episodes of fiscal consolidation. Our results suggest that this improvement results from a portfolio re-balancing from private to public debt securities which reduces the risk-weighted value of assets. In fact, if fiscal adjustment efforts are perceived as a structural policy change that improves the sustainability of public finances and, therefore, reduces credit risk, the banks' demand for government securities increases relative to other assets.

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1 Introduction

The interdependence between public and bank balance sheets has been a fundamental aspect of the financial and economic crisis which escalated in 2008 with the default of Lehman and turned into a sovereign debt crisis in mid-2010. Governments strongly loosened their fiscal policies to counter the severe economic downturn that resulted from the financial market turmoil. As a result, government deficit and debt ratios skyrocketed in many industrialized countries. In some cases, the combination of large fiscal imbalances and low growth potential as well as structural weaknesses in the economy or the financial system led markets to increasingly challenge the sustainability of

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public finances. It is therefore widely agreed that sizable and sustained fiscal adjustments will be necessary to restore sound fiscal positions and ease financial market pressures. Consequently, most industrialized countries have by now announced medium-term consolidation strategies which would lead to a significant fiscal tightening over the coming years. In this context, this paper analyzes the effects of fiscal consolidations on banking sector stability.

We mainly see two channels through which fiscal adjustment could affect bank balance sheets. First, a direct effect of fiscal consolidation runs through the portfolio choice of banks. If a fiscal adjustment is perceived to reduce the credit risk of a sovereign borrower, a bank's demand for the bonds of this issuer should increase relative to other assets, thereby changing the bank's portfolio in the direction of a lower risk composition. A second indirect channel runs through the macroeconomic effects of fiscal contractions. Based on the standard Keynesian view, a fiscal tightening would exert a negative impact on GDP in the short run which tends to reduce banks capital bases, e.g. due to loan losses, and therefore weaken standard measures of capital adequacy (see, e.g., Goodhart et al. (2004)).

Controlling for the indirect macroeconomic channel, we test the portfolio choice hypothesis using a very rich data set including more than 160,000 individual bank balance sheet observations for 17 industrialized countries, from 1994 to 2009. As a measure of fiscal consolidations, we rely on the new data set constructed by the IMF (see Devries et al. (2011)), which extends to a large set of advanced economies the "narrative approach" proposed in Romer and Romer (2010) for the US.

Exploiting both time series and cross sectional variation, we relate changes in capital adequacy ratios to periods of fiscal consolidations. Our baseline regressions use the Tier-1 and the total (risk-weighted) capital ratio. Both these indicators have been shown to be good predictors of bank failure. We find that fiscal consolidations are associated with an improvement in banks' capital bases, a result that is robust with respect to different panel estimation approaches, and that is strongly driven by commercial banks. Our results suggest that the improvement of capital ratios is attributed to banks re-balancing their portfolios from private securities to government securities.

The literature has not yet explored in much detail, neither empirically nor theoretically, the potential transmission from fiscal policy to bank balance sheets. To the best of our knowledge, this is one of the first papers to provide evidence on the existence of direct transmission channels.

The remainder of the paper is organized as follows. Section 2 discusses related literature and outlines the potential transmission mechanisms from fiscal policy to banks. Section 3 presents the data sets that we use, the empirical approach and discuss the results. Section 4 reports several robustness exercises. Finally, section 5 concludes.

2 Theoretical considerations and related literature

While a substantial body of theoretical work develops the link between monetary policy and bank balance sheets (e.g., the literature on the bank lending channel and the financial accelerator), there is a remarkable lack of research that investigates the channels through which fiscal policy can affect bank balance sheets.

In this paper we focus on periods of fiscal consolidation. In this context, we see two channels that would establish a link between fiscal policy and banks' balance sheets:

First, a direct channel would be related to supply and demand effects on government bond markets. The supply of new government bond issuances will decline in times of a sustained adjustment of budgetary positions. At the same time, ambitious fiscal consolidation efforts may be regarded by investors as a structural policy change which improves long-run fiscal sustainability. A related lower perceived risk of default would increase the demand for government securities relative to other asset classes, thus, counteracting the supply side effect. Which of the two effect prevails theoretically depends on the specific features of the demand and supply curves. Focusing on the banks balance sheet, we would tend to observe an increase in the share of government securities over total assets if the demand effect prevail, and a decrease in such share if the supply effect is stronger.

A second, and indirect, channel would be related to the macroeconomic effects of fiscal consolidations. If fiscal adjustment leads to an economic downturn, it would increase the likelihood of non-performing loans and write-offs. If those effects are strong, one should observe more investment in government securities when a country enters a period of fiscal consolidation.

Overall, the qualitative and quantitative effects of a fiscal consolidation on bank balance sheets are therefore uncertain and will be addressed in our empirical analysis.

As regards the related literature - while the recent financial crisis has triggered more research on the role of the banking sector in dynamic stochastic general equilibrium (DSGE) models - this line of research is still at a relatively early stage. Angeloni et al. (2011) propose a calibrated DGSE model that includes a banking sector and the government sector. The focus of the paper is on the composition of the fiscal adjustment, and on its consequences for banking stability: they find that an adjustment strategy based on increases in labor taxes is the one that destabilizes the financial sector (i.e. increases the likelihood of bank runs) the most. At the same time, consolidation strategies based on cuts in expenditure are less harmful. However, the authors do not propose an empirical test based on standard capital adequacy ratios, and on historical data for fiscal consolidation episodes.

Dib (2010) and Darracq-Paries et al. (2010) also present DSGE models that include both a banking sector and a fiscal sector. While fiscal policy is not the focus of either paper, Dib (2010) reports the impulse responses of bank balance sheet items to a structural shock to government spending. In this model, loans decrease and banks' equity goes down (which is partially compensated for by more interbank borrowing) in response to a positive government spending shock, i.e. a fiscal expansion. Bank leverage (which is the inverse of the Tier-1 capital ratio) initially increases, but then decreases before it returns to the steady state.

In a partial equilibrium framework, Caballero and Krishnamurthy (2004) develop a crowding-out channel of private investment that works indirectly through the economy. In their model, fiscal expansions decrease the loan supply for private investment through a crowding-out effect. In addition, lenders may fear fiscal irresponsibility in times of fiscal expansions, further decreasing the supply of loans. Overall, the paper develops a link between private lending and fiscal policy, but does not speak directly to banks' balance sheets.

Turning to empirical work, a vast literature investigates the transmission of monetary policy to

bank balance sheets[1], but the potential transmission of fiscal policy is largely unexplored.

In a recent paper, Igan and Aydin (2010) apply the framework of Kashyap and Stein (2000) to fiscal policy in Turkey to test the crowding-in effect of fiscal contractions. They argue that banks with a retail focus should display more of a crowding-in effect, but they conclude that the evidence is weak and seems to hold only for certain types of loans. Hauner (2008) examines the effect of credit of banks to the government in a country panel, and finds a positive effect on profitability of banks in emerging economies, but not in advanced economies.

All in all, to the best of our knowledge an empirical analysis on the consequences of fiscal consolidation episodes on banks balance sheets - which exploits a very rich data set of micro data - has not been undertaken so far.

3 Empirical analysis

3.1 Data description

We collect data from three different sources. Individual bank balance sheet data are obtained from the BankScope data base, macroeconomic variables are from the OECD Economic Outlook data base, and the data on fiscal consolidation episodes come from the recently published IMF fiscal consolidation data base (see Devries et al. (2011)). We use annual data from 1994 to 2009 which is mainly due to the joint availability of bank balance sheet data and fiscal consolidation data. Our analysis is further restricted to the 17 countries for which fiscal consolidation data are available. The OECD Economic Outlook data base is a standard data base on macroeconomic time series that needs no further description. The BankScope balance sheet data have been used extensively in the existing financial literature, but to the best of our knowledge this is the first paper that uses this data set in the context of fiscal policy analysis.

The BankScope data comprise a very large sample of banks, mainly from the US and Europe, but also from other countries. The available data include balance sheet information and income statement information at the annual frequency. Overall, the initial dataset comprises 311,345 bank-year observations. The coverage of banks has increased over time, e.g. there are 7928 observations for 1994 and 20,558 observations for 2009, which makes our starting panel unbalanced. We exclude the banks of countries for which we do not have data on fiscal consolidations. Starting from this data set, we focus on commercial banks, savings banks and cooperative banks as those are the most common type of banks in most countries, and also those that are mainly involved in the lending business. We further restrict the sample to banks for which we have unconsolidated balance sheet data. Consolidated balance sheet data which include figures for the parent company and subsidiaries (that could be active in other branches or other countries) would make it harder to justify the identification of a domestic effect of a fiscal consolidation on the balance sheet of the parent bank. Finally, a very small number of banks changes the end of their business year. Since our regressions are mostly based on changes in balance sheet items, we drop those banks to avoid

[1]See, for instance, Bernanke and Blinder (1992), Kashyap and Stein (1995) or Kashyap and Stein (2000).

timing issues. The resulting set of banks by country and year is shown in table 1. Overall, the dataset used for the empirical analysis comprises therefore 161,787 observations. For around 50% of the banks, 9 or more annual observations are available. Annual observations raise from 3421 in 1994 to 11,631 in 2009. The number of banks increases significantly in 1999, which is largely due to an increased coverage of US banks.

Table 2 reports some summary statistics for the data set. In particular, the 10-th, 50-th and 90-th percentiles of the Tier-1 capital ratio, the total capital ratio, total assets and the return on assets are shown. The Tier-1 capital ratio is equal to the Tier-1 capital (mostly equity and retained earnings) divided by risk-weighted assets. Total capital equals the sum of Tier-1 capital and Tier-2 capital, where Tier-2 capital adds other classes of stocks (e.g. cumulative perpetual preferred stocks) and subordinated debt. The total capital ratio is the total capital divided by risk-weighted assets. The first six columns of the table show that capital ratios tended to increase, on average, over the time span considered. However, they decreased somewhat during the period 1999-2001 and, more prominently, in the recent crisis period of 2007-2009. Such decrease is especially marked for banks in the top 90-th percentile. Total asset (evaluated in millions of US dollars) dropped significantly in 1999, mainly due to the fact that many small banks were added to the data set in this year. Finally, the return on assets decreased remarkably in the context of the 2007-2009 global financial crisis.

The IMF data set on fiscal consolidations is a newly released data set that compiles information from various sources (mainly IMF reports and Budget Speeches) to construct a variable that captures exogenous and unsystematic (i.e. unrelated to cyclical conditions) fiscal consolidation efforts. Romer and Romer (2010) were the first to apply the "narrative approach" to study the effects of fiscal policy in the US, based on a newly constructed quarterly data set of tax changes.[2] In contrast to this work, the IMF data are available on an annual basis, and cover both the spending and the revenue side. Observations are available for 17 countries (Australia, Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Ireland, Italy, Japan, Netherlands, Portugal, Sweden, UK, USA) from 1978 to 2009. A fiscal consolidation effort is defined as any measure that was implemented with the intention to reduce the government budget deficit. The final figures reflect the estimated impact of a measure relative to GDP at the time when it came into effect. Overall, the data set contains 173 episodes of fiscal consolidation efforts. The period under investigation (1994-2009) includes 82 episodes. The mean fiscal consolidation for this period is 0.94% of GDP with a standard deviation of 0.89. A detailed description of the data set construction can be found in Devries et al. (2011), and a comparison to a more conventional measure, i.e. the change in the cyclically adjusted primary balance (CAPB), is carried out in Guajardo et al. (2011).

As an alternative measure of fiscal consolidations, we use the year-to-year change in the CAPB. The CAPB is widely used by international institutions such as the European Commission, the IMF and the OECD, for fiscal monitoring. However, it has been criticized as not truly reflecting

[2]See also Agnello and Cimadomo (2012) for a narrative study on the cyclical stance of discretionary fiscal policies in EU countries, based on a dataset of discretionary fiscal measures collected within the European System of Central banks (ESCB).

exogenous changes to the fiscal policy stance. For example, as noted by Guajardo et al. (2011), a boom might cause capital gains and cyclically adjusted tax revenues to rise, which can lead to an increase in the CAPB even if no fiscal consolidation effort was undertaken. In addition, policy makers might respond to recent economic conditions, and e.g. raise taxes when demand is high, which tends to reverse causality between fiscal policy and economic conditions, a point noted in Romer and Romer (2010). This criticism seem to be less of a problem for our research question since we are interested in direct effects of fiscal policy on bank balance sheets, and not in the indirect effects which work through the economy. Finally, it could be the case that fiscal consolidations are followed by adverse shocks in subsequent periods due to shocks to the economic environment, reversing or diminishing the effect on the CAPB (Guajardo et al. (2011) provide examples). We try to deal with this last point to some extent by defining a fiscal consolidation episode as an improvement of the CAPB of at least .5 percentage points. We think that this might better capture exogenous fiscal consolidation efforts, and it mitigates the concern that small improvements in the CAPB could be as much a fiscal consolidation as a measurement error. Guajardo et al. (2011) show that results based on the narrative approach can differ from results based on the CAPB approach by both sign and magnitude. For the reasons outlined above, we think that the narrative approach (or historical approach) should be better suited to account for exogenous fiscal consolidations that were implemented to reduce past budget deficits. It is, therefore, our preferred measure of fiscal consolidations in the analysis below.

3.2 Specification

Our baseline econometric specification is similar to Romer and Romer (2010) and Guajardo et al. (2011). We estimate the equation

$$y_{ij,t} = \sum_{s=1}^{j} \alpha_s y_{ij,t-s} + \sum_{s=0}^{p} \gamma_s FC_{i,t-s} + \sum_{s=0}^{l} \beta_s X_{t-s} + \mu_j + \lambda_t + \epsilon_{ij,t}, \tag{1}$$

where i denotes the country, j denotes the bank and t denotes time. The dependent variable is y_{ij}, which represents our banking stability measure. X_t includes bank-specific and country-specific macroeconomic controls at time t, λ_t is a time fixed effect, and FC_i is the fiscal consolidation variable. For the latter, we incorporate the contemporaneous value (i.e., $s = 0$) and a lagged value (i.e., $s = 1$) consistently with the idea that consolidations may elicit their effects with some delay. As shown in Brewer et al. (2008), there might be variation of capital ratios that can be attributed to the banking sector characteristics of a country. Therefore, bank fixed effects μ_j are introduced.

As mentioned, $y_{ij,t}$ labels the change in the Tier-1 and total capital ratios at the bank level. Risk-based capital ratios are meant to capture different risk profiles of banks. In this framework, loans to the private sector carry a higher risk weight than bonds (and sub-categories of loans and bonds also carry different risk weights) since they are regarded as less liquid and relatively likely to default. Hence, higher values of the risk-weighted capital ratios imply higher stability.

The two capital ratios described above are commonly taken as the most important indicators for the stability of a bank, and for its protection against adverse shocks to its assets. For example, in an application to US banks, Estrella et al. (2000) shows that risk-weighted capital ratios are strong predictors of bank failure, and outperform simple balance sheet ratios for longer horizons.

As for bank specific variables, we include the log of total assets as a proxy for banks size, and the return on average assets as a measure of bank profitability. Earlier research has found that larger banks or more profitable banks have systematically different capital structures than other banks (see e.g. Brewer et al. (2008) or Gropp and Heider (2009)).

We include macroeconomic variables to capture the effects of the business cycle (output gap), and other factors that should affect the portfolio choice of banks such as the the interest rate term spread and the debt to GDP ratio as a proxy for the size of the government bond market. Further, in line with the previous literature, we include interaction effects of our fiscal consolidation variable and the bank-level variables in all regressions.

We apply standard panel data methods to estimate our baseline specification. This enables us to exploit time series variation as well as cross sectional variation in the data. Since our baseline specification includes the lagged dependent variable, standard fixed effects panel data regressions might be subject to the Nickell bias. Therefore, we opt for the Arellano-Bond estimator that uses lagged values of the variables to construct a large number of instruments, and that can be shown to be consistent in this framework. As a robustness check, we also report results based on fixed effects estimation including or excluding the lagged dependent variable. The results are similar to our baseline estimation (see Section 4).

3.3 Results

First, we look at the effect of fiscal consolidations on capital ratios in a sample including all banks. Table 3 shows the results from our baseline regressions. The first two columns report the results when the growth rate in the Tier-1 capital ratio is used as the dependent variable, and the last two the results when the growth rate in the total capital ratio is employed.

Overall, we observe that episodes of fiscal consolidations tend to improve the capital adequacy ratios of banks. The size of the effect differs between the two measures of fiscal consolidation, but the coefficient is positive and significant for both measures. According to our estimates based on the narrative measure, the expected cumulative change of the Tier-1 ratio after one year to a 1% fiscal consolidation is around 12% (which reflects the sum of the contemporaneous coefficient and the lagged one). For the median bank in our sample, this corresponds to an increase of about 1.5 percentage points of the Tier-1 capital ratio. The estimated response based on the CAPB is lower, but it is still within the 90% confidence bands when we consider the contemporaneous effect, and within the 99% confidence bands when we consider the lagged effect.

The effect on the total capital ratio is also positive and significant, but somewhat lower than the effect on the Tier-1 capital ratio. After one year, the response to a 1% fiscal consolidation is approximately a 9% change in the growth rate. This corresponds to around 1.35 percentage points

increase in the Total capital ratio for the median bank in our sample. The coefficient associated with the CAPB is lower, but still positive and significant.[3]

The estimates also indicate that larger banks and less profitable banks tend to have higher capital ratios. In addition, the coefficient associated with interaction terms suggest that larger banks and banks with higher returns in the previous period respond less to a fiscal consolidation. This can be due to the fact that portfolio decisions of the biggest banks - which are generally also the most profitable - are primarily driven by factors other than national economic policies. These effects are overall small: for the median bank with total assets of USD 150 billion and a return of 0.7%, the estimated effect varies between 2% to 5% reduction of the effect on the capital ratios relative to the baseline effect.

Regarding macroeconomic controls, only the difference in the long vs. short-term interest rate spread enters the regressions significantly, and positively, throughout all specifications. This effect may be related to the fact a steeper yield curve is generally associated with expectations of sustained economic recovery, which can be also reflected in improved capital adequacy indicators. Finally, the debt to GDP ratio has a positive effect, which is however generally not significant.

Our sample comprises three categories of banks: commercial banks, credit cooperatives and savings banks. In order to better understand the driving forces of the result, we report results by bank type in table 4. For simplicity, we report only the coefficient associated with the fiscal consolidation variable and we show the cumulative effect of a fiscal consolidation after one year, i.e. the sum of the contemporaneous and the lagged coefficient. We observe that the cumulated point estimate of a consolidation is positive throughout all specifications, but not always significant. We find strongest effects for commercial banks, and non-significant effects for credit cooperatives. For savings banks, the estimates suggest weakly significant effects or non-significant effects. our interpretation for this finding is related to the business model of each bank category. We think of savings banks and credit cooperatives as mostly providing loans to small businesses. Hence, the trade-off between loan and bond investment does not lie at the heart of their business models. However, it is a more important driver of business for commercial banks.

3.3.1 Compositional effects

In this section, we investigate the drivers behind our finding of a positive effect of fiscal consolidations on banks' capital ratios. In order to do so, we take a closer look at the components of the capital ratios in order to inspect potential channels. Equation (2) provides a stylized definition of the Tier-1 capital ratio:

$$Tier1\ ratio_t = \frac{Tier1\ capital_t}{(L_t^f + \theta_1 L_t^c) + (\theta_2 B_t^i + \theta_3 B_t^g)}, \quad 1 > \theta_1 > \theta_2 > \theta_3. \tag{2}$$

[3] Romer and Romer (2010) and Guajardo et al. (2011) also tend to find stronger effect on macroeconomic variables based on their narrative measures, compared with alternative measures such as cyclically-adjusted indicators.

L_t^f denotes loans to firms at time t, L_t^c denotes loans to consumers (e.g. mortgages), B_t^i denotes investment securities and B_t^g are government securities. The θ_i's are risk weights between the different items. This formulation shows that risk-weighting changes across assets, also within the asset classes of loans and securities. Generally, the Basel accords allow a risk weight of 0% for government debt, and risk weights are higher for bank debt or investment grade corporate debt (20%). Mortgage loans carry a risk weight of 50% and corporate loans have a risk weight of 100%. In equation (2), we can think of $\theta_1 = 50\%, \theta_2 = 20\%$ and $\theta_3 = 0\%$.[4]

Turning again to equation (2), note that an increase in the capital ratios can be driven by an increase in the numerator, a decrease in the denominator or, *ceteris paribus*, i.e. while keeping the aggregate asset portfolio constant, by a compositional effect in the denominator (a shift from more risky to less risky assets). To see why this would lead to a reduction of the denominator, recall that bonds carry a lower risk weight than loans. For the purpose of illustration, assume that corporate loan holdings of USD 100, which have a risk-weighted value of 100, are shifted to government bond holdings. Since government bonds carry a risk weight of 0, the risk weighted value of USD 100 is now 0, without any change in total assets. However, the Tier1 ratio would increase, driven by a decrease in the denominator of equation (2). More generally, any compositional effect that reduces exposure to assets associated with a higher risk weight, and shifts the value to assets with a lower risk weight, will reduce the value of risk weighted assets (and increase the Tier1 ratio).

In order to disentangle these effects, we investigate separately the changes triggered by fiscal consolidations on the numerator and the denominator of equation (2). We run the regression specification in equation (1), while using the change in the respective quantity as our dependent variable. Table 5 reports results for both capital ratios, and for both measures of fiscal consolidations. In all cases, we find negative and 99% significant effects on the denominator. The narrative measure yields insignificant results for the numerator, whereas the CAPB delivers a negative estimate. In every case, however, the difference between the growth rates of denominator and numerator is significantly positive, indicating that the main reaction is driven by changes in the denominator of the respective capital ratio.

We, therefore, focus on investigating the composition of risk weighted assets in response to a fiscal consolidation.[5] In particular, we test if fiscal consolidation induces banks to shift asset holdings from the private sector towards the public sector. This would reduce the volume of risk-weighted assets because the shift is mainly towards asset classes that carry a lower risk weight.

We approximate banks' public sector holdings by their holdings of government bonds, and we use different measures as proxies for the private sector. Our main restriction is the availability of data once we zoom in on individual balance sheet items. Our broadest measure of the *private sector* includes customer loans and corporate loans, investment securities and trading securities. We further define a measure of the *corporate private sector* as corporate loans, investment securities and trading securities. One concern expressed in Kashyap and Stein (2000) is that some items cannot

[4]Note that the implementation of the Basel accords differs slightly across countries, but the coefficients reported here broadly reflect the ones of the countries analyzed in the paper.

[5]An assessment of the response of total assets yields a non-significant estimate of the cumulated effect of a fiscal consolidation on asset growth (results not shown, available from the authors).

be adjusted quickly and, therefore, may not display responses to policy changes. Kashyap and Stein suggest to look at a subcategory that might display more immediate adjustment. We therefore add *adjustable corporate private sector*, consisting of corporate loans and trading securities, as a third measure of private sector exposure. Due to lack of data availability, we lose around 90% of the observations in our sample for this part of the analysis.

The structure of our econometric approach remains the same. However, our dependent variable is now given by the growth rate of $\frac{Private_t}{Public_t}$, where $Private_t$ is one of the measures defined above, and $Public_t$ is government bond holdings. This allows us to investigate the growth of private sector exposure relative to public sector exposure. In line with our previous results and discussion, we would expect that public sector exposure grows stronger relative to private sector exposure following a fiscal consolidation. Taking risk-weighting into account, this would then imply a lower value for risk-weighted assets.

Table 6 reports the results. We find a strong negative response of the growth rate of private sector exposure relative to public sector exposure after a fiscal consolidation. The coefficient estimates are robust for all our different measures of the private sector. This result is consistent with the hypothesis of portfolio re-balancing towards the public sector following a fiscal consolidation.

4 Robustness

The regression results presented in table 3 have already been shown to be robust to two different measure of fiscal consolidation, and to two alternative capital ratios. This section presents some additional robustness tests. In particular, we provide results based on a restricted time period and country sample. We also add dummy variables that capture different types of financial crises and control for exchange rate effects. In addition, we present results based on alternative estimation procedures. Finally, we show results using an alternative measure for banking stability, i.e. the expected default probability. Results are reported in tables 7, 8 and 9.

4.1 Sub-sample analysis and crisis episodes

Table 7 reports our test on whether the recent financial crisis period may have driven the baseline results. We therefore run a regression on a sample that excludes data in and after 2007. In addition, we report results excluding US banks. In fact, as reported in table 1, the panel includes a large number of US banks, and we cannot exclude that these banks systematically differed from the rest of our sample. In a similar spirit, major financial crises such as banking, stock market and currency crises, could affect both capital ratios and, subsequently, fiscal consolidations. To this aim, we used the data set on crises published in Reinhart and Rogoff (2009). We also test if changes in the exchange rate of the national currency relative to the US dollar - as an alternative measure of currency distress - had an impact on the analysis.

As can be seen from Table 7, which reports the cumulated regression coefficient for FC and $CAPB$, our main results remains qualitatively unaffected from limiting the time period to the

years up to 2006. The same holds true when we control for the dates of stock market, banking and currency crises or for variation in the exchange rate. Limiting the sample to banks outside the United States - under the narrative approach - results in a somewhat more sizeable effect of fiscal consolidation on the two capital adequacy ratios, while the effect based on the $CAPB$ is statistically not significant.

4.2 Alternative estimation approaches

We also assess the robustness of our baseline estimate to different econometric approaches (see table 8). Instead of using the Arellano-Bond estimator as in the baseline exercise, we run the same specification using a least squares dummy variable (fixed effects) approach. This estimator potentially suffers from the Nickell bias when a lagged dependent variable is included as a regressor. In addition, we use the fixed effects estimator in a static framework, that is without the lagged dependent variable on the RHS. Angrist and Pischke (2008) (page 246) show that, under some assumptions, if a regression based on fixed effects is efficient but one uses the Arellano-Bond estimator, estimates tend to be too small. If one uses fixed effects estimation, but Arellano-Bond is appropriate, estimates tend to be too big. In that sense, we can think of the two estimates as bounding the effect of interest from below and above. Table 8 reports the estimated cumulated effect of a fiscal consolidation after one year. For all specifications, the estimated effect is significantly positive. The estimated growth rates of the capital ratios vary between 5% and 12%, and tend to be slightly larger for the regressions based on the narrative measure.

4.3 Expected default frequencies

While previous research has shown that the capital ratios that we consider in this paper are good predictors of bank failure, testing our findings based on other measures seems reasonable for robustness purposes. An alternative measure of bank stability is the price of credit default swaps on banks, which should give a good indication on how markets perceive the likelihood of default. However, these exist only for a very small subset of banks, and time series are too short to assess the effects of fiscal policy. Furthermore, reliable estimates of default probabilities at the bank level are hard to come by for many countries.

Therefore, we use estimates of expected default probabilities of the financial sector at the country level. Kamakura corporation provides estimates of the expected default probabilities based on a hazard rate estimation approach taken by Chava and Jarrow (2004).[6] This model is derived using logistic regression to go beyond older credit scoring techniques and the 20- grade approach of legacy rating agencies.

Our regressions are conceptually the same as in the baseline. However, we use only data at the country level for this analysis since the data on expected default probabilities is not available on the individual bank level. The results are shown in table 9. Fiscal consolidations turn out

[6]See http://www.kamakuraco.com/. Indicators developed by Kamakura are widely use for country monitoring used by the private sector and international institutions.

to have a significant negative effect on the expected default frequency, even considering different quartiles of the distribution of default probabilities. The effect is in the range of reducing default probabilities by .5 to 1 percentage points. Since capital ratios generally correlate negatively with default probabilities, this is consistent with our previous findings.

5 Conclusion

The existing literature has not yet explored in much detail, neither empirically nor theoretically, the potential transmission from fiscal policy to bank balance sheets. This paper analyzes the effects of fiscal consolidations on banking sector stability. If a fiscal adjustment is perceived to reduce the credit risk of a sovereign borrower, a bank's demand for the bonds of this issuer should increase relative to other assets, thereby changing the bank's portfolio in the direction of a lower risk composition. This would improve standard capital adequacy ratios, such as the Tier-1 ratio, which have been shown to be good predictors for the likelihood of a bank failure.

We empirically test this hypothesis using disaggregated bank balance sheet data for 17 countries from 1994 to 2009. As a measure of fiscal consolidations, we rely on a newly constructed data set that uses historical accounts to build a large country panel of episodes of fiscal consolidations.

We find that fiscal consolidations indeed are associated with an improvement in banks' capital bases, a result that is robust with respect to different panel estimation approaches, and that is strongly driven by commercial banks. Our results suggest that the improvement of capital ratios is attributed to banks re-balancing their portfolios from private securities to government securities.

The interdependence between public and bank balance sheets has been a fundamental aspect of the financial and economic crisis. At the same time, there is broad consensus that sizeable and sustained fiscal adjustment will be required in virtually all major economies with a view to restoring the sustainability of public finances in the aftermath of the crisis. Therefore, future work on this topic, notably on the theoretical side, seems necessary to better understand the channels through which fiscal policy affects banking stability.

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Table 1: Bank-year observations by country

Year	1994	1995	1996	1997	1998	1999	2000	2001	
Country									
AT	67	74	78	127	136	142	160	172	
AU	31	34	37	30	30	27	27	28	
BE	76	81	85	77	65	64	60	58	
CA	10	11	12	12	12	10	16	12	
DE	1542	1723	1810	1790	1973	1931	1806	1686	
DK	83	91	93	92	95	95	101	95	
ES	131	142	153	158	149	137	146	154	
FI	6	6	6	6	6	6	7	6	
FR	344	344	341	321	316	308	310	306	
GB	65	94	118	123	130	131	132	134	
IE	11	15	16	19	23	24	26	27	
IT	245	304	348	612	617	683	668	704	
JP	42	164	167	167	188	800	798	772	
NL	28	36	40	37	37	34	31	36	
PT	17	19	22	24	25	25	23	23	
SE	8	9	10	9	9	12	14	95	
US	715	715	707	703	651	8788	8956	9069	
Total	3421	3862	4043	4307	4462	13217	13281	13377	

Year	2002	2003	2004	2005	2006	2007	2008	2009	Total
Country									
AT	179	220	239	245	256	257	234	194	2780
AU	26	25	23	25	25	27	25	18	438
BE	65	67	58	53	49	41	36	33	968
CA	11	12	13	16	18	17	17	16	215
DE	1553	1442	1421	1704	1717	1698	1648	1567	27011
DK	92	90	94	95	97	97	111	100	1521
ES	152	145	148	191	192	101	151	159	2409
FI	6	8	9	8	6	8	11	11	116
FR	284	272	254	257	245	240	233	213	4588
GB	141	145	162	136	132	126	132	113	2014
IE	30	29	33	32	33	31	26	24	399
IT	688	678	676	1172	648	661	641	503	9848
JP	713	661	630	618	606	595	587	575	8083
NL	36	33	33	33	30	30	29	24	527
PT	22	21	20	21	20	22	23	20	347
SE	95	96	90	94	89	84	76	73	863
US	9134	9145	8925	8788	8633	8492	8251	7988	99660
Total	13227	13089	12828	13488	12796	12527	12231	11631	161787

Note: Bank-year observations after adjustments to the data set as described in the text.

Table 2: Summary statistics: Banks

	Tier-1 capital ratio			Total capital ratio			Total assets (Mill USD)			Return on assets		
Year	p10	p50	p90	p10	p50	p90	p10	p50	p90	p10	p50	p90
1994	8.20	12.40	24.70	10.30	14.00	26.20	119.70	576.60	4995.70	0.03	0.36	1.28
1995	8.20	12.50	26.20	10.40	14.10	27.80	104.10	580.65	5218.20	0.07	0.38	1.45
1996	8.10	12.00	25.20	10.40	14.00	27.60	97.50	590.50	5600.80	0.06	0.37	1.46
1997	8.10	12.20	24.10	10.40	13.70	27.30	77.50	543.00	5531.40	0.08	0.38	1.55
1998	8.50	14.30	30.60	10.30	15.15	31.50	68.40	503.20	5475.70	0.08	0.37	1.49
1999	9.60	14.80	30.40	10.80	15.70	31.40	24.71	117.07	1729.30	0.08	0.79	1.62
2000	9.50	14.20	29.90	10.60	15.20	31.00	25.35	123.04	1804.90	0.05	0.84	1.73
2001	9.40	13.80	28.00	10.70	14.90	29.20	27.98	133.64	1925.33	0.02	0.79	1.65
2002	9.50	13.90	28.40	10.70	15.00	29.50	29.81	143.06	2024.90	0.03	0.84	1.74
2003	9.60	13.90	29.10	10.80	15.10	30.30	31.21	153.31	2089.90	0.07	0.83	1.75
2004	9.50	13.90	29.20	10.70	15.00	30.20	32.70	165.30	2291.50	0.10	0.84	1.75
2005	9.60	13.80	29.50	10.80	14.90	30.40	34.45	172.52	2190.21	0.12	0.85	1.84
2006	9.60	13.70	30.30	10.76	14.80	31.24	35.28	180.18	2375.47	0.10	0.83	1.82
2007	9.50	13.50	30.10	10.60	14.50	30.40	37.36	189.84	2530.90	0.00	0.72	1.71
2008	9.30	13.00	27.40	10.60	14.30	27.60	40.72	203.72	2668.95	-0.97	0.43	1.49
2009	9.41	13.17	25.66	10.60	14.44	26.00	43.98	215.77	2666.71	-1.49	0.34	1.35

Note: p10, p50 and p90 are the 10%, 50% and 90% percentiles over all banks in a given year. Return on assets is the return on average assets.

Table 3: Regressions of the change in capital ratios on consolidations

	Tier 1 capital ratio	Tier 1 capital ratio	Total capital ratio	Total capital ratio
lagged dep	-0.015	-0.015	-0.018	-0.017
	(0.007)	(0.007)	(0.007)	(0.007)
FC_t	0.082		0.044	
	(0.022)		(0.023)	
FC_{t-1}	0.044		0.053	
	(0.020)		(0.018)	
$CAPB_t$		0.015		0.015
		(0.009)		(0.008)
$CAPB_{t-1}$		0.033		0.023
		(0.009)		(0.008)
FC_tSIZE_{t-1}	-0.011		-0.007	
	(0.003)		(0.003)	
$FC_{t-1}SIZE_{t-1}$	-0.004		-0.006	
	(0.003)		(0.002)	
FC_tROAA_{t-1}	-0.007		0.002	
	(0.009)		(0.010)	
$FC_{t-1}ROAA_{t-1}$	-0.013		-0.018	
	(0.007)		(0.006)	
$CAPB_tSIZE_{t-1}$		-0.002		-0.002
		(0.001)		(0.001)
$CAPB_{t-1}SIZE_{t-1}$		-0.003		-0.002
		(0.001)		(0.001)
$CAPB_tROAA_{t-1}$		0.001		0.001
		(0.001)		(0.001)
$CAPB_{t-1}ROAA_{t-1}$		-0.001		-0.001
		(0.001)		(0.001)
$SIZE_{t-1}$	0.166	0.167	0.163	0.164
	(0.008)	(0.008)	(0.008)	(0.008)
$ROAA_{t-1}$	-0.004	-0.004	-0.003	-0.004
	(0.001)	(0.002)	(0.001)	(0.001)
GAP_t	-0.004	-0.004	0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta(r_{l,t-1} - r_{s,t-1})$	0.009	0.015	0.011	0.014
	(0.003)	(0.003)	(0.002)	(0.002)
$Debt_t$	0.045	0.122	0.054	0.100
	(0.057)	(0.060)	(0.054)	(0.055)
constant	-0.850	-0.909	-0.853	-0.890
	(0.055)	(0.056)	(0.052)	(0.052)
N	73956	73956	75038	75038

Note: Arellano-Bond results, standard errors in parentheses. First two regressions are for the Tier-1 ratio, the last two are for the Total capital ratio. The dependent variable is the change in the respective ratio. FC is the consolidation measure based on the narrative approach, $CAPB$ is the consolidation measure based on the CAPB. $SIZE$ is the log of total assets, $ROAA$ is the return on average assets. GAP is the output gap, $r_l - r_s$ is the term spread and $Debt$ is the debt-to-gdp ratio. Bank-specific variables are winsorized at the 1% level.

Table 4: Cumulative effect of 1% fiscal consolidation by bank type

	Tier 1 capital ratio		Total capital ratio	
	FC	$CAPB$	FC	$CAPB$
Commercial banks	0.215	0.073	0.137	0.062
	(0.086)	(0.018)	(0.065)	(0.016)
Cooperative banks	0.060	-0.059	-0.003	0.048
	(0.064)	(0.203)	(0.057)	(0.154)
Savings banks	0.082	0.018	0.192	0.030
	(0.110)	(0.036)	(0.114)	(0.031)

Note: Arellano-Bond estimates. First two regressions are for the Tier-1 ratio, the last two are for the Total capital ratio. The dependent variable is the change in the respective ratio. All regressions include the full set of control variables as in the main regression. Table compares cumulative effects for different bank types. FC is the consolidation measure based on the narrative approach, $CAPB$ is the consolidation measure based on the CAPB. Standard errors are in parentheses.

Table 5: Cumulative effect of a 1% fiscal consolidation

	Tier 1 capital ratio		Total capital ratio	
	FC	$CAPB$	FC	$CAPB$
Numerator	-0.004	-0.033	-0.013	-0.043
	(0.021)	(0.011)	(0.023)	(0.010)
Denominator	-0.135	-0.100	-0.118	-0.093
	(0.028)	(0.012)	(0.031)	(0.012)
Difference	0.131	0.067	0.105	0.050
	(0.036)	(0.016)	(0.038)	(0.015)

Note: Arellano-Bond estimates. FC is the consolidation measure based on the narrative approach, $CAPB$ is the consolidation measure based on the CAPB. The dependent variable is the change in the numerator or denominator of the respective capital ratio. All regressions include the full set of control variables as in the main regression. Each entry reports the cumulative effect of a consolidation after one year. The results for the difference are based on Welsh's t-test. Standard errors are in parentheses.

Table 6: Growth of volume shares relative to the public sector

	all priv	*all priv*	*corp priv*	*corp priv*	*adj corp*	*adj corp*
lagged dep	-0.036	-0.035	-0.025	-0.021	-0.016	-0.012
	(0.036)	(0.036)	(0.039)	(0.041)	(0.040)	(0.042)
FC_t	-0.132		-0.242		-0.249	
	(0.222)		(0.239)		(0.306)	
FC_{t-1}	-0.592		-0.602		-0.683	
	(0.174)		(0.192)		(0.243)	
$CAPB_t$		-0.262		-0.246		-0.160
		(0.212)		(0.225)		(0.280)
$CAPB_{t-1}$		-0.035		-0.053		0.067
		(0.241)		(0.256)		(0.314)
FC_tSIZE_{t-1}	0.022		0.032		0.034	
	(0.034)		(0.036)		(0.044)	
$FC_{t-1}SIZE_{t-1}$	0.014		0.013		0.006	
	(0.020)		(0.021)		(0.026)	
FC_tROAA_{t-1}	0.065		0.074		0.068	
	(0.055)		(0.058)		(0.072)	
$FC_{t-1}ROAA_{t-1}$	0.057		0.061		0.093	
	(0.046)		(0.049)		(0.062)	
$CAPB_tSIZE_{t-1}$		0.052		0.051		0.044
		(0.025)		(0.026)		(0.034)
$CAPB_{t-1}SIZE_{t-1}$		-0.001		0.002		-0.012
		(0.030)		(0.032)		(0.040)
$CAPB_tROAA_{t-1}$		0.115		0.095		0.099
		(0.067)		(0.071)		(0.087)
$CAPB_{t-1}ROAA_{t-1}$		0.057		0.049		0.042
		(0.068)		(0.073)		(0.091)
$SIZE_{t-1}$	0.020	0.096	0.022	0.086	0.014	0.098
	(0.318)	(0.315)	(0.329)	(0.327)	(0.393)	(0.389)
$ROAA_{t-1}$	-0.067	-0.079	-0.072	-0.074	-0.089	-0.070
	(0.034)	(0.066)	(0.035)	(0.070)	(0.045)	(0.088)
GAP_t	-0.124	-0.059	-0.152	-0.083	-0.166	-0.076
	(0.052)	(0.044)	(0.059)	(0.048)	(0.079)	(0.061)
$\Delta(r_{l,t-1} - r_{s,t-1})$	-0.032	0.020	-0.028	0.036	0.022	0.090
	(0.070)	(0.053)	(0.079)	(0.059)	(0.102)	(0.077)
$Debt_t$	-0.535	-0.435	-0.752	-0.628	-0.805	-0.681
	(0.385)	(0.369)	(0.415)	(0.399)	(0.497)	(0.482)
constant	0.557	-0.171	0.756	0.084	0.872	0.006
	(2.295)	(2.263)	(2.373)	(2.346)	(2.842)	(2.801)
N	3873	3873	3873	3873	3897	3897

Note: Arellano-Bond estimates. *all priv* is the entire private sector, *corp priv* is the corporate private sector and *adj corp* is the adjustable corporate sector as defined in the text. The dependent variable is the growth rate of the ratio of the column variable and the public sector. FC is the consolidation measure based on the narrative approach, $CAPB$ is the consolidation measure based on the CAPB. $SIZE$ is the log of total assets, $ROAA$ is the return on average assets. GAP is the output gap, $r_l - r_s$ is the term spread and $Debt$ is the debt-to-gdp ratio. Bank-specific variables are winsorized at the 1% level. Standard errors in parantheses.

Table 7: Robustness to sub-samples and controls: Cumulative effect of a 1% fiscal consolidations

	Tier 1 capital ratio		Total capital ratio	
	FC	CAPB	FC	CAPB
Baseline	0.126	0.048	0.097	0.038
	(.027)	(.013)	(.026)	(.011)
Pre-crisis (1994-2006)	.099	.036	.096	.024
	(.034)	(.015)	(.029)	(.013)
Excluding US	.180	-.079	.125	-.084
	(.037)	(.082)	(.032)	(.056)
Controlling for banking crises	.128	.048	.098	.039
	(.027)	(.013)	(.026)	(.011)
Controlling for stock market crises	.146	.042	.116	.033
	(.028)	(.013)	(.026)	(.011)
Controlling for curreny crises	.092	.048	.077	.037
	(.028)	(.013)	(.027)	(.011)
Controlling for exchange rate	.125	.064	.096	.051
	(.027)	(.014)	(.026)	(.012)

Note: Arellano-Bond estimates. Each entry provides the estimated cumulated effect of a 1% fiscal consolidation on the growth rate of the respective capital ratio. FC is the narrative measure of fiscal consolidations, CAPB is a fiscal consolidation derived from changes in the cyclically-adjusted primary balance. All regressions include the full set of control variables as in the main regression. Standard errors are in parantheses.

Table 8: Robustness to estimation method: Cumulative effect of a 1% fiscal consolidation

	Tier 1 capital ratio		Total capital ratio	
	FC	$CAPB$	FC	$CAPB$
Arellano-Bond	0.126	0.048	0.097	0.038
	(0.027)	(0.013)	(0.026)	(0.011)
Fixed effects, dynamic	0.061	0.071	0.051	0.065
	(0.017)	(0.010)	(0.016)	(0.009)
Fixed effects, static	0.060	0.065	0.057	0.079
	(0.016)	(0.010)	(0.016)	(0.008)

Note: Arellano-Bond estimates. First two regressions are for the Tier-1 ratio, the last two are for the Total capital ratio. The dependent variable is the change in the respective ratio. Table compares cumulative effects under different model specifications. FC is the consolidation measure based on the narrative approach, $CAPB$ is the consolidation measure based on the CAPB. All regressions include the full set of control variables as in the main regression. Standard errors are in parentheses.

Table 9: Change of expected default probabilities

	EDP75	EDP50	EDP25	EDP75	EDP50	EDP25
FC_t	-1.312	-0.907	-0.659	-1.385	-0.935	-0.646
	(0.220)	(0.315)	(0.156)	(0.242)	(0.346)	(0.166)
FC_{t-1}	-0.019	0.087	0.147	-0.026	0.098	0.160
	(0.190)	(0.193)	(0.244)	(0.193)	(0.190)	(0.241)
GAP_t	-0.174	-0.053	-0.034	-0.101	-0.014	-0.031
	(0.091)	(0.049)	(0.042)	(0.083)	(0.048)	(0.042)
$\Delta(r_{l,t-1} - r_{s,t-1})$	0.001	-0.026	-0.006	0.035	-0.048	-0.018
	(0.094)	(0.093)	(0.064)	(0.170)	(0.159)	(0.116)
Debt_t	0.032	0.017	0.017	0.033	0.017	0.017
	(0.011)	(0.007)	(0.008)	(0.013)	(0.010)	(0.010)
Unemployment_t				0.004	0.010	-0.010
				(0.079)	(0.075)	(0.059)
ΔGDP_t				-11.611	-5.862	-1.384
				(9.971)	(6.093)	(6.211)
$r_{l,t-1} - r_{s,t-1}$				-0.033	0.041	0.035
				(0.069)	(0.061)	(0.061)
EDP75_{t-1}	-0.593			-0.602		
	(0.171)			(0.177)		
EDP50_{t-1}		-0.423			-0.424	
		(0.091)			(0.088)	
EDP25_{t-1}			-0.332			-0.334
			(0.075)			(0.073)
constant	-2.017	-0.933	-0.933	-1.958	-0.688	-0.837
	(1.112)	(0.655)	(0.677)	(0.552)	(0.585)	(0.720)
N	121	121	121	121	121	121

Note: Arellano-Bond estimates. $EDP75$ is the 75% percentile of the default probability distribution, $EDP50$ is the 50% percentile and $EDP25$ is the 25% percentile. The dependent variable is the change in the column variable. The dependent variable is the change in the respective ratio. FC is the consolidation measure based on the narrative approach. GAP is the output gap, $r_l - r_s$ is the term spread and *Debt* is the debt-to-gdp ratio. Standard errors in parantheses.