The Effect of Financial Depth on Monetary Transmission

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The Effect of Financial Depth on Monetary Transmission

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Abstract

Several papers have looked at the relationship between country-specific factors and the strength of monetary transmission. Cecchetti (1999) concentrated on legal aspects, De Grauwe and Storti (2004) more on the financial structure of the economy. The objective of this paper is to measure how financial development variables influence the strength of monetary transmission in European countries. This paper employs a meta-analysis technique that has gained much popularity in recent years. According to the results, monetary transmission in Europe is strongly influenced by financial depth and structure.

JEL Code: E3, E4, E5, E6

Keywords: monetary transmission, financial depth, meta-analysis

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Contents

1. Introduction

Various papers have shown that monetary transmission – the impact of a change in interest rate on prices and output – is different across the euro area (see Kieler and Saarenheimo (1998), Guiso et al. (2000) and Peersman (2004) and others). There are not only differences in dynamics, but also in the magnitude of the reaction of output and prices to shocks. Understanding of the reasons why these differences exist, can be used to analyse convergence of monetary transmission in the euro area countries. Equally, it is possible to formulate other policies, for instance budgetary spending, in order to find the right policy mix.

The number of papers explaining the differences in monetary transmission is increasing quickly. Cecchetti (1999) used legal factors to explain the differences across countries. Elbourne and de Haan (2004) showed that these results depend heavily on the particular monetary policy model employed for the estimation. Recently, De Grauwe and Storti (2004) have used several macroeconomic and financial variables to explain the differences in the transmission between countries.

The objective of this paper is to measure how financial development variables influence the strength of monetary transmission in European countries. The differences have been evaluated using meta-analysis technique[1]. Data from papers estimating the impacts on several European countries have been employed. The strength of this selection is that it is possible to remove all country, methodology, publication and other specific effects.

The paper is organized as follows. The second section includes a broader theoretical and empirical discussion of the financial deepening factors that might influence the strength of monetary transmission. The third section describes the data. In the fourth section, a small meta-study is undertaken to analyse how financial depth indicators influence the EU-15 countries. The fifth section concludes.

2. Financial Depth and Monetary Transmission

There are three main definitions of financial depth: monetary aggregate to GDP ratio or monetisation, debt to GDP ratio or indebtedness and stock market capitalization to GDP ratio. Although the three variables are proxies for the same thing, they should be treated separately. The reason is the structure of the financial markets.

[1]The methodology of the meta-analysis is presented in Stanley (2001).

For monetary policy to operate, households and firms have to use money. The base money can be obtained from the (local) central bank. In addition to the base money, banks create money by giving out loans. The more (local) money is used in their transaction, the more they are influenced by the decisions of that (local) interest rate. When interest rates are changed, only those using local money will be directly influenced by that decision.

In a closed economy, increase in monetisation can take place only through domestic loan activity. In an open economy, the broad money and debt are less related and loans can be taken without necessarily increasing the stock of money. The important difference between money and debt is how interest rates are set. Money in a bank account earns interest at a rate that is influenced by the policy rate. There can be deposits with fixed and variable interest rates and different durations. The same holds for loans that have different interest rates and durations. However, the average loan contracts are longer and the interest rates might be fixed for longer time. This is also true in the case of "relationship banking", where customers can be protected from the adverse effects of the money market. Hence, it is expected that monetisation would have a higher impact on transmission than the loans. The influence of loans might be negative if loan interest rates are fixed for a longer period. Banks can buffer some liquidity and help clients to continue taking loans at lower interest rates than those on the financial markets. This leads to the issue of the structure of the banking industry – the role of competition, health and legal issues.

Stock market capitalisation (SMC) is a proxy for the availability of non-bank finance. Monetary shocks work through several channels. First there is portfolio adjustment – if banks offer higher interest rates on deposits then holding money instead of bonds becomes more attractive. In addition there is the wealth effect – the more stocks there are on the market, the greater the change in the absolute value of the stocks (change in SMC) and hence more wealth relative to GDP. In general, a bigger stock market increases the effect of transmission, but since it can also operate as an alternative source of financing next to the financial sector, the relative share of the stock market over the financial sector results in weaker monetary transmission as households and firms have another source of financing.

Empirical evidence on the effect of the financial depth is limited. De Grauwe and Storti (2004) discuss several macroeconomic and financial factors such as the rate of inflation, the size of the economy, openness, exchange rate regimes and banking sector's asset to gross domestic product (GDP) ratio alongside paper specific factors such as the publication date or the time period used to estimate the relation. Their estimation shows that only some are statistically significant for the short run effect, namely inflation and the publication

date. There are more variables significant for the long-run analysis, but results vary depending on effects on prices and output.

Financial liberalisation and the concurrent increase in financial depth has been analysed in Thailand by Sirivedhin (1998). She shows that although financial markets have developed, foreign money markets strongly influenced the transmission of domestic monetary policy. As the two processes took place simultaneously, it was not possible to distinguish between the magnitudes of the two effects.

More descriptive evidence on the financial markets in the Czech Republic, Hungary and Poland in the paper by Anzuini and Levy (2004) show the major differences these countries have with respect to the core euro zone countries. Using both vector autoregressive (VAR) and structural VAR (SVAR) models, Anzuini and Levy find that despite inferior financial development, macroeconomic variables react in a standard way, which is similar to that of more advanced economies. With this absence of asymmetric effects, Anzuini and Levy conclude that there are no significantly different effects of monetary policy concerning the sample countries and the EU-15. The drawback of the paper is that by only comparing the new member countries, they are unable to make conclusions about the strength of the transmission.

The seminal paper about differences in monetary transmission by Cecchetti (1999) concentrates on the legal factors. The author shows that legal factors are important in determining the strength of monetary transmission and that macroeconomic factors are not. These conclusions were based on an estimated VAR model. About five years later Elbourne and de Haan (2004) estimated several different VAR models and showed that Cecchetti's (1999) results depend on the type of VAR model used. The conclusion is that in the bigger VAR model with more consistent estimates only weak evidence can be found in favour of Cecchetti's (1999) results.

A cross-country analysis for 10 transition economies was written by Elbourne et al. (2004). Using a VAR model they find generally negative responses for inflation and output on a contractionary interest rate shock. One important result is that the impact of a shock arrives sooner than in the more advanced countries. In a second step they present a rank correlation analysis for measuring the linkage of monetary transmission and financial structure indicators. For this purpose they collect descriptive information concerning the structure and health of banks and the importance of external and bank finance for the non-financial sector. They find distinctive differences concerning these variables across the sample, however there were only three significant correlations. They conclude that there is no clear evidence of linkages between the financial structure and the impact of monetary shocks.

Table 1: Papers used in the analysis

Paper	Method	Time period
Cecchetti (1999)	Country-specific structural VAR	1976:III – 1997:IV (varying periods across countries)
Clements et al. (2001)	VAR EMU-simulation	1983 – 1998
Ehrmann (2000)	Country-specific structural VAR	1979:III – 1997:IV (varying periods across countries)
Mojon and Peersman (2001)	Country-specific VAR	1970 – 1998 (varying periods across countries)
Angeloni et al. (2002)	Country-specific VAR, macroeconometric models	1971 – 2000

3. Description of the Data

Monetary transmission measures have been taken from five papers: Cecchetti (1999), Clements et al. (2001), Ehrmann (2000), Mojon and Peersman (2003) and Angeloni et al. (2003). The latter paper is divided into four subpapers as there are two modelling strategies and two different time horizons. An overview of these papers is given in Table 1. In all these papers, the impulse responses are estimated for several EU-15 countries. This allows to take better into account the paper specific factors, which is more difficult when impacts are collected one-by-one from papers.

The strength of monetary policy transmission is measured as the impact of a monetary policy shock on output and on inflation or prices. The cumulative impact would be the correct measure to use. However, papers often report the maximum impact or the size of the impact after one, two or three years, and the cumulative impacts are not available. Cumulative impact is only used when the impact of a monetary shock to price level is presented. For the other cases maximum different from the baseline inflation is used, usually two or three years after the initial shock.

All these papers have in common that they provide a cross-country analysis, which makes it easier to compare the impacts, although they are using different methods, variables, shock sizes and sample periods. The sample periods vary from twelve to thirty years. The absolute values and standard deviations of the impulses vary significantly from paper to paper. For a better comparison the standard deviation of the impact for each paper was calculated.

Figure 1 shows the impact of monetary shocks on output measured in standard deviations for each of the countries. It can be seen from the Figure that the estimated impact is not homogeneous across all papers. If the estimated impacts were similar, then the lines on the Figure should be parallel in the same way that there are similarities in the Angeloni et al. (2003) results of two and three years in the macroeconomic model.

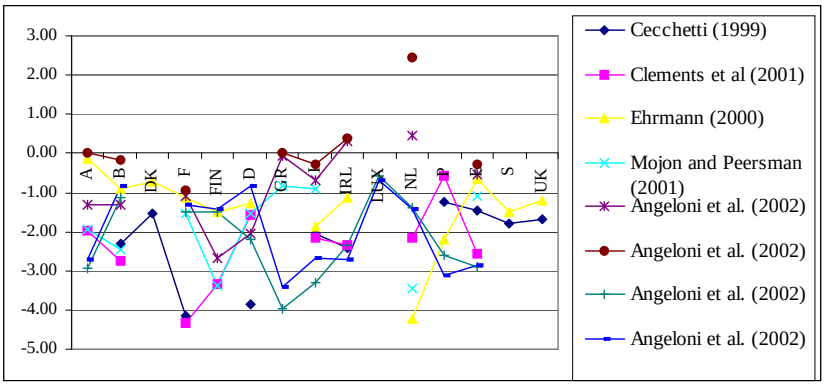

Figure 1: Impacts on output by paper and country measured in standard errors

Figure 2 presents the data measured in standard deviations for impacts on inflation or prices. The Cecchetti (1999) and Ehrmann (2000) papers use inflation while the remaining papers use impacts on prices. As inflation returns to its average value some years after the shock, the maximum impacts on inflation are used to make the outcomes comparable. It can be seen that the average impact in standard deviations is, in broad terms, the same for the papers using inflation and prices. The paper by Ehrmann (2000) only measures the impact on output, and there is one data series left for prices.

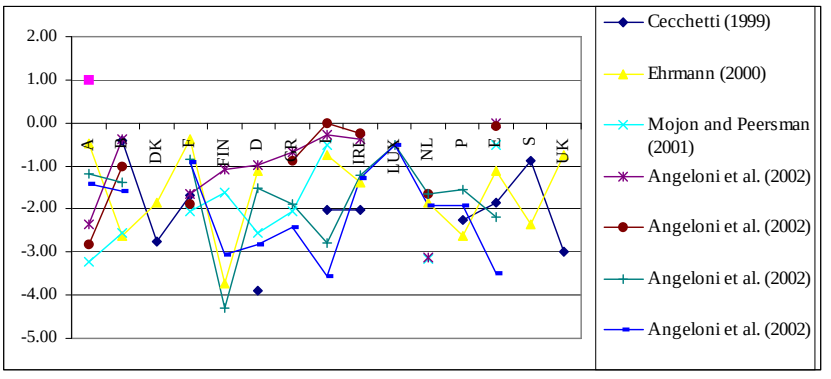

Figure 2: Impacts on prices by paper and country measured in standard errors

Financial depth is measured using three variables: the ratio of M2 to GDP, the ratio of domestic credit to GDP and the stock market capitalisation (SMC) to GDP ratio. The financial sector structure is measured using the SMC/Debt ratio. The data for M2, domestic credit and GDP are taken from the International Monetary Fund (IMF) International Financial Statistics (IFS) database. For broad money, M2 is used as the broadest money available for all countries.

Table 2: Correlations of the financial ratios and the output and price impacts

	Output			Prices		
	M2	**Debt**	**SMC**	**M2**	**Debt**	**SMC**
Cecchetti (1999)	-0.14	0.43	-0.07	0.44	0.02	0.03
Clements et al. (2001)	-0.64	-0.26	0.25			
Ehrmann (2000)	-0.02	-0.01	0.49	-0.2	-0.43	-0.06
Mojon and Peersman (2001)	-0.16	-0.5	0.68	0.5	0.28	0.39
Angeloni et al. (2003) VAR – 2 years	-0.06	0.06	-0.37	0.46	0.09	0.68
Angeloni et al. (2003) VAR – 3 years	-0.13	0.14	-0.73	0.61	0.2	0.25
Angeloni et al. (2003) macroeconometric models – 2 years	-0.38	0.07	-0.54	-0.47	-0.36	-0.42
Angeloni et al. (2003) macroeconometric models – 3 years	-0.27	-0.16	-0.43	-0.49	0.08	-0.55
All papers	-0.11	0.08	-0.12	-0.1	-0.09	-0.16

The proxy used for direct capital access is the total financial assets of institutional investors to GDP ratio taken from the OECD Institutional Investors Statistical Yearbook. The latter series starts in 1993, and therefore expresses the differences present at the end of the period.

For each observation of monetary transmission on output or prices, a separate financial depth measure is calculated, which is the average financial depth for this country for a particular period. The database contains 86 different estimates of the impacts of monetary shocks on output and 76 estimates of the impacts of monetary shocks on inflation or prices.

4. Analysis of the Strength of Monetary Transmission

Preliminary information about the direction of the relationship can be acquired by using simple correlation analysis. The monetary transmission impacts are measured as for an adverse monetary shock; hence the impacts are negative. In order to have a high impact positively related to higher financial depth, the impacts are multiplied by minus one. Hence, the expected correlation coefficient between the impact variable and indebtedness or monetisation should be positive, and the sign on the stock market capitalisation GDP ratio either positive or negative depending on the dominating effect. The results are presented in Table 2.

The correlation coefficients vary strongly from paper to paper. Most of the correlations are small and unexpectedly negative. Correlations including all papers show nearly no correlation. Part of this variance can be attributable to the specifics factors of the studies – for example data definitions, selected sample periods, estimation methods, publication biases etc. In order to take

out paper and country related aspects, a regression analysis is used.

The estimated regression is the following:

$$MT_{ij} = \alpha_0 FD_{ij} + \alpha_1 D_i + \alpha_2 D_j + \epsilon_{ij}, \quad (1)$$

where, MT_{ij} – country i and paper j specific impact on output or prices, FD_{ij} – country and paper financial development indicator(s), D_i – paper dummies, D_j – country dummies, α – estimated parameters, ϵ – residual.

The paper dummies contain information about the method used and author specific factors. The country dummies include information about possible differences in economic structures. First, the parameters of Angeloni et al. (2002) have a weight of 0.5 to account for their dual time horizon measures in all the regressions. Second, a weighting system is designed to put more emphasis on the observations that are closer to the average impact and less emphasis on those that are further away from the average as outliers, both for output and prices. The calculation of weights is presented in the following equation.

The estimated regression is the following:

$$W = log \left\{ \frac{1}{|\mu_{ij} - \mu_i|/\sigma_i} \right\}, \quad (2)$$

where, W – is the calculated weight, μ_{ij} – the country j and paper i specific impact, μ_i – the average impact in the paper i, σ_i – the standard deviation of the impacts of the paper i.

The estimation procedure is to include both paper and country dummies in the equation and remove the statistically insignificant ones testing jointly for the loss of information with a Wald coefficient restrictions test using F and Chi-square test statistics. The list of statistically significant dummies is presented below the results.

The results of the regression on the output impacts are presented in Table 3. All variables are in natural logarithms with the exception of the dummies and the SMC/Debt ratio. The regressions on the individual financial depth ratios all show a positive sign on the magnitude of the impact. Higher financial deepening brings stronger transmission. The results are statistically significant for the monetisation and SMC ratios but insignificant for the indebtedness. The insignificant indebtedness might mean that banks do partly protect their customers from changes in interest rates.

The results do not change for the equation where all the variables are included. The M2 and Debt ratios remain positive, but M2 is statistically significant only when weights are used in the equation. The indebtedness ratio is not statistically different from zero. In the equation with weights the SMC ratio

is negative, but statistically insignificant. The ratio of SMC/indebtedness is negative and statistically significant. This implies that a higher share of stock market leads to lower transmission of monetary policy.

The values for the estimated parameters are almost all below one. This means that by increasing financial depth by one per cent, the transmission increases by less than one per cent. This is the expected result. The differences in the adjusted R^2 are different for the models with and without weights when all dummies are included in the model, hence the differences in the descriptiveness comes solely from the fact that two different sources of data are used in the regression.

Table 3: Impacts on output (T-stat below the parameter)

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	without weights	**with weights**	**without weights**	**with weights**	**without weights**	**with weights**	**without weights**	**with weights**
M2/GDP	0.16	0.42					0.11	1.06
	(1.45)	(5.18)					(0.7)	(4.18)
Debt/GDP			0.15	0.31			0.01	0.16
			(0.41)	(1.13)			(0.01)	(0.28)
SMC/GDP					0.51	0.23	0.57	-0.15
					(3.5)	(1.56)	(3.09)	(-0.68)
SMC/Debt							-0.15	-0.08
							(-6.45)	(-3.16)
Dummies	D3-7, Dk, Lux	D2-7, Dk, Fin, Lux, Nl, S	D3-7, Dk, Lux	D2-7, B, Dk, D, Lux	D3-6, Dk, Lux, UK	D2-7. B, Dk, Lux, UK	D3-6	D2-6, F, Fin, I, Nl, S
Observ.	76	76	78	78	73	73	71	71
Adj. R^2	0.58	0.89	0.57	0.88	0.58	0.88	0.58	0.89

The situation concering the impacts on inflation and prices is more complicated (results presented in Table 4). It is known from the literature that the effects of monetary transmission on inflation are more difficult to measure. It has often been found that prices increase after an adverse monetary shock rather than decrease as expected – the so called "price puzzle". There are various ways to solve the problem, but as the papers used in this meta-analysis have been estimated with similar VAR models for all countries, hence specific problems may not be solved individually. This is also reflected in the results of the meta-regression.

The M2 and SMC ratios have a positive impact on the strength of the transmission, but the values of the estimated parameters are relatively high, especially for the equation without weights. The indebtedness has negative value and is statistically significant for the equation with weights. The negative sign is unexpected: even if banks shield their customers from changes in the money market, the overall effect should still be positive when only this ratio is used to explain the transmission.

In the regression where all four financial variables are included, indebtedness only has a negative sign when weights are used. Unexpectedly, the M2 ratio is negative in the equations. According to the theory, the SMC ratio has a positive sign, but the SMC/Debt ratio a negative sign. More capital markets increase the transmission, but if the SMC growth is higher than growth in debt, then this weakens the transmission as firms have alternative sources of financing available.

Table 4: Impacts on inflation or prices (T-stat in below the parameter)

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	without weights	**with weights**	**without weights**	**with weights**	**without weights**	**with weights**	**without weights**	**with weights**
M2/GDP	3.85	1.01					1.03	-4.53
	(6.22)	(3.91)					(4.37)	(-2.71)
Debt/GDP			-1.83	-2.42			-1.71	1.7
			(-1.03)	(-2.59)			(-2.71)	(2.22)
SMC/GDP					1.39	0.81	0.64	1.9
					(8.76)	(25.57)	(4.6)	(4.63)
SMC/Debt							-0.19	-0.23
							(-12.00)	(-15.52)
Dummies	D5, D7-8, B, Dk, F, Fin, D, I, Irl, Lux, Nl. S	D3, D5, D6-8, B DK F D GR I IRL LUX NL P E	D4-6, B, Dk, F, Fin, D, I, Irl, Lux, Nl, P, E, S. Uk	D3, D5-6, B, Dk, F, Fin, D, I, Irl, Lux, Nl. P. E. S.	D4-6, B, Dk, F, Gr, Lux, Nl, S, UK	D5, D8, Dk, F, Fin, D, I, Lux, Nl, P, E, S	D5-6, Dk	D5-6, B, Dk, F, Fin, D, I, Nl, E, S
Observ.	70	70	72	72	66	66	64	64
Adj. R^2	0.33	0.94	0.31	0.94	0.28	0.92	0.23	0.94

All the results, but especially the impact on prices, depend on the equation estimated. The use of weights provided more information from the observations that were closer to the average impact of the paper and treated other observations more like outliers. Hence the estimated parameters reflect different information. Changes in the parameter values and signs mean that the relations might not be linear. Also, there are many other factors that influence transmission at the same time – for example stabilisation of the economic environment can coincide with an increase in the financial depth, the effects might cancel each other out. The same hold for the R^2 ratios as for the model about inflation, where the differences in the descriptiveness comes from the fact that with weighting different data is used to estimate the regression and it is not the effect of the dummies.

5. Conclusions

The meta-analysis concentrated on the countries of the European Union. There is some evidence that countries with greater financial depth have also had stronger transmission of monetary shocks. Greater relative importance

of stock market capitalisation compared to indebtedness, however, decreases the effect of the shock. The statistical evidence on the relationship between financial depth and prices is not so clear, with the exception of the relative size of the stock market capitalisation with respect to debt, where the effect is negative.

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