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Monetary Transmission in an Open Economy: The Differential Impact on Exporting and Non-Exporting Firms[1]

By

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Abstract

Using firm-level data from the 1990s for publicly traded manufacturing companies in Israel, a liberalized and open economy, we find that monetary policy affects real investment and that the effect operates differentially on the firms in our sample - the greater its export intensity, the less a firm is affected by tight money. We examine several interpretations and conclude that the evidence indicates that the impact is transmitted primarily through the balance sheets of firms whose access to foreign currency funding is relatively constrained.

I. Introduction

In a liberalized economy with free international capital flows and no credit market imperfections, tight money should have little or no effect on the real investment of firms, especially firms that have access to foreign currency denominated funds. This is particularly true in a small economy that does not affect international interest rates. We test this conjecture using a panel of firm-level data in Israel - a small and open economy that since the early 1990s also qualifies as a liberalized economy. We use export intensity as a measure of accessibility to foreign currency denominated funds, finding that monetary policy has a significantly smaller effect on export intensive firms.

We consider several interpretations. Tight money may affect the real activity of firms by directly reducing the domestic demand for their products. Alternatively, tight money may induce an inflow of foreign capital that generates an appreciation of the exchange rate, and this may affect the real investment of firms, for example through the price of imported raw materials or of exported goods. The empirical analysis suggests that demand-side and exchange rate effects are not the driving forces behind our empirical findings.

Our results are best interpreted as evidence for a supply-side effect centered on financial market imperfections: monetary policy is transmitted primarily through the balance sheets of firms with limited access to foreign currency denominated funds. In a *closed* economy, the balance sheet effect works as follows: a higher domestic interest rate reduces the discounted value of the collateralizable assets and the present value of future revenue streams of firms, diminishing banks' willingness to lend to them (and possibly resulting in credit rationing for some). This idea is presented and tested in Gertler and Gilchrist (1994) and Bernanke, Gertler, and Gilchrist (1996) who show that small US manufacturing firms respond more strongly to tight money than larger firms. A central element of their interpretation is the differential response of small and large firms to tight money, where small firms are regarded as

more likely to be liquidity-constrained or credit rationed.[1]

In an *open* economy, the balance sheet effect works somewhat differently since the future revenue of export intensive manufacturing firms (that typically produce tradable goods) should not be discounted with the domestic interest rate. Indeed, casual observation suggests that an increase in the domestic interest rate does not affect the amount of credit that such firms obtain. This may be because local banks are more willing to supply funds to export intensive firms, or because these firms themselves are more willing to borrow despite the high domestic interest rate.[2] In either case, the transmission of monetary policy operates through the balance sheet of the firms. Its impact varies across firms due to financial market imperfections that give an edge to export intensive firms in obtaining credit.[3]

We provide empirical evidence that supports this hypothesis: the greater the export intensity of a firm, the less tight money affects its real investment.[4] For every firm in our sample, we construct year-by-year Flow of Funds charts by combining information from two

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[1] See also Whited (1992), Oliner and Rudebusch (1996), and Hu (1999). In these studies, the basic result - that tight money affects credit-constrained or liquidity-constrained firms - still holds when the sample is split according to other firm characteristics that proxy for liquidity constraints. Barth and Ramey (2000) and Dedola and Lippi (2000) study related issues in a dynamic framework finding, too, that monetary policy affects real economic activity, and that the transmission of monetary policy operates through the supply-side.

[2] Foreign banks should also be more inclined to supply funds to export intensive firms and, in addition, such firms have access to foreign trade credit. Therefore, they have more bargaining power vis-a-vis domestic banks.

[3] Without financial markets imperfections, all firms - exporting or not - should be indifferent as to the source of credit (and external funding in general). The notion that, in a closed economy, monetary policy is transmitted to the real economy through credit market imperfections is formalized in Bernanke and Blinder (1988), Bernanke and Gertler (1989), and Gertler (1992).

[4] We further split the sample according to whether a firm is listed only in Israel or dually (in Israel and the US) finding that the latter firms are also less affected by tight money. Again, this is consistent with the view that firms with access to alternative funding sources (other than local currency bank loans) are less likely to face liquidity constraints or credit rationing. The dually listed firms in our sample exhibit above average export intensity, so the two proxies of accessibility to foreign currency denominated funds are not independent.

sources: (1) flow statements that publicly traded companies are required to provide since 1990; and (2) profit and loss and balance sheet data. The flow statements allow us to compute firm-level year-by-year investment in fixed assets and investment in inventory.[5] We also compute Tobin's q, the ratio of market value to replacement cost, for each firm in our sample on a year-by-year basis.

Using this panel data set, we estimate the determinants of firm-level investment controlling for various firm characteristics such as size, age, leverage, and sub-industry. As a "side benefit," we obtain interesting (and robust) results regarding the empirical performance of various theories of investment; for example, we find that Tobin's q positively affects firm-level investment in fixed assets but not in inventories, and that there is a significant "accelerator" effect, namely, that firm-level investment is positively related to the growth rate of its level of activity (sales).[6]

In empirical studies, "monetary shocks" are sometimes identified through analysis of historical records. This methodology was suggested by Friedman and Schwartz (1962), revived by Romer and Romer (1989), and applied to the study of monetary transmission by Romer and Romer (1990). Other studies (e.g., Bernanke and Blinder (1988)) rely on short-term interest rates as proxies for monetary policy, as we do here. In the next section, we explain why short-term rates can be regarded as reasonably exogenous to investment during the sample period under consideration.[7]

The empirical literature on monetary transmission through firms' balance sheets is closely related to the micro-literature that deals with liquidity constraints more generally. In

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[5] For example, the flow statements report gross rather than net investment thus avoiding errors in the measurement of investment generated by price changes and vintage effects.

[6] The theories of investment that we address in our empirical work are described in Section 4.

[7] Long-term rates are, of course, endogenous as they equilibrate the demand for new capital and the supply of saving.

that literature, economic agents are identified as liquidity constrained on the basis of characteristics that proxy for ease of access to bank credit (e.g., in Zeldes (1989) poor consumers are regarded as credit constrained) or abundance of cash and cash equivalents (e.g., in Fazzari, Hubbard, and Petersen (1988) firms that do not distribute dividends are regarded as cash constrained).[8] Here, we use export intensity as a measure of accessibility to foreign currency denominated funds. Our empirical findings are consistent with the earlier conclusion of the literature that liquidity and credit constraints indeed matter for real economic activity and that monetary policy has real effects.[9] We extend this conclusion by providing evidence that even in an open and liberalized economy, domestic monetary policy may affect real activity through firm-level supply-side effects.[10]

In the next section, we present the relevant macroeconomic background focusing on monetary policy and foreign capital flows to the country during the 1990s. In Section 3, we survey four central theories of investment that our empirical work addresses. In Section 4, we describe the data, in particular, the Flow of Funds charts and the computation of Tobin's q. In Section 5, we display and interpret the empirical results, and Section 6 concludes the paper.

II. Macroeconomic Background

Monetary policy in Israel in the 1990s

Monetary policy in Israel during the 1990s was in some periods expansionary and in others tight. Since 1992 the government has announced inflation targets every year. At the end

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[8] Bernanke, Gertler, and Gilchrist (1996) utilize the ratio of bank loans to short term liabilities and whether the firm has commercial paper outstanding as bank dependence criteria (in addition to firm size).

[9] Moreover, as our sample consists of publicly traded firms, the effect should be even stronger for privately held smaller firms.

[10] We stress that our results do not indicate that tight monetary policy affects investment through a reduction in loanable funds, since the banks in Israel have convenient access to foreign money markets, and have been able to obtain credit abroad whenever local funds became expensive.

of 1993 and until mid-1995, nominal interest rates were raised to fight inflation. During that period, real short-term rates also rose. Tight monetary policy was implemented at the end of 1996 and during 1997 as well. The top panel of Figure 1 displays two measures of the "real short-term interest rate" - the rate on monetary loans to commercial banks announced monthly by the Bank of Israel,[11] and a weighted average (across banks) of the interest rate on non-indexed overdraft credit for businesses.[12] The fluctuations of the real short-term interest rate over time during the period 1990-1998 are clearly visible. Since the real short-term interest rate that firms pay is the real interest rate on non-indexed overdraft credit to businesses, we mainly use this measure in our analysis.[13] The high correlation between the two rates during the sample period suggests that the empirical results should not be sensitive to the particular measure used (as we confirm in the actual analysis).

Of course, the policy instrument used by the Bank of Israel is the *nominal* interest rate. An important input (among other indicators[14]) to the Bank's rate setting decision process are inflation expectations, calculated as the yield differential on non-indexed and indexed tradable Israeli government bonds of the same maturity. Since inflation expectations are calculated using public information, firms perceive the real interest rate once the nominal rate is set by the Bank. Thus, in most of the analysis, we use the real interest rate (the nominal interest rate deflated by inflation expectations), but to check the robustness of the results, we repeat some

[11] Every week the Bank of Israel provides loans to the commercial banks (or obtains deposits from them). The trading procedure is complex but, essentially, the interest rate at which this market clears is that announced by the Bank of Israel.

[12] We provide more details in Section 4.

[13] Moreover, visual inspection of the series suggests that the rate on monetary loans to commercial banks may not be stationary whereas the interest rate on non-indexed overdraft credit to businesses is clearly mean-reverting.

[14] For example, monetary aggregates, exchange rates, capital inflows etc.

regressions using the nominal interest rate and inflation expectations as separate regressors.[15]

During most of the sample period,[16] monetary policy in Israel was directed uniquely towards reducing inflation, and responded primarily to nominal variables and inflation expectations, not to real economic conditions. Moreover, during most of the 1990s, actual GDP was smaller than estimated "potential" GDP, so there were no perceived inflationary pressures from the product market that might have affected monetary policy (contrary to the US, where there have been several episodes where the Fed deliberately attempted to slow down the economy to fight inflation). Thus, during the time period examined here, it seems that the short-term interest rate is (certainly to a first approximation) exogenous to the real investment of firms.[17,18]

Financial liberalization and foreign currency denominated funds

During the 1990s, as a result of financial liberalization and the tight monetary policy in Israel, many firms obtained increasing amounts of foreign currency denominated credit (mainly from local banks). The middle panel of Figure 1 displays the rise in the share of foreign currency denominated credit as a fraction of the total credit extended to the private sector in Israel.[19] This rise was particularly steep during the years 1994-1997 when domestic interest rates rose sharply. In fact, from the top two panels of Figure 1 it appears that the interest rate on non-indexed overdraft credit and the share of foreign currency denominated

[15] During most of the sample period, inflation expectations decreased from year to year, and most of the displayed variation in the real interest rate originated in fluctuations of the nominal interest rate (not shown).

[16] Mainly except for the end of 1993 and 1994.

[17] The eight-year period we study is too short for implementing the historical approach of identifying monetary shocks (as in Romer and Romer 1989).

[18] See Leiderman (1999) and Leiderman and Bar-Or (1999) for analyses of monetary policy in Israel.

[19] There are no data regarding the amount of foreign currency denominated credit to the manufacturing sector.

credit are positively correlated suggesting that firms *responded* to tighter money by raising funds abroad (directly or via local banks).[20]

Another important source of foreign funds for Israeli firms were Initial Public Offerings of stocks abroad, mainly in New York. As reported in Blass and Yafeh (2001), by 1995 the number of NASDAQ-listed Israeli firms nearly equaled the number of all other foreign firms combined (excluding Canadian companies). A minority of these firms were dually listed, in New York and in Tel Aviv, and are included in our sample.

Investment

The bottom panel of Figure 1 displays investment in fixed assets, and in inventories, aggregated over the firms in our sample (publicly traded manufacturing firms excluding software firms and holding companies) during the 1990s. In the first half of the decade, the displayed rise of investment in fixed assets was no doubt driven by the immigration wave from the former Soviet Union. Figure 1 further suggests that in the second half of the decade, there was a negative relation between investment and the short-term interest rate, but it is hard to argue that the decline in investment was *caused* by the rise in short-term rates since it may reflect a "natural" decline in investment due to the decline in immigration to the country, or to a change in investor sentiment as a result of political factors.

[20] This is particularly true for the interest rate on non-indexed overdraft credit to businesses.

A firm-level micro-analysis that exploits cross-sectional heterogeneity across firms can help assess whether short-term rates had any effect on investment. We argue that not all firms have equal access to foreign currency denominated funds. In particular, export-intensive firms can more easily raise such funds. Indeed, during the 1990s, local banks often required firms seeking foreign currency denominated credit to provide foreign currency denominated assets as collateral, or to demonstrate foreign currency denominated revenue sources, as a hedge against exchange rate risk. These considerations lead us to investigate whether the investment of export-intensive manufacturing firms responds differently (if at all) to domestic short-term interest rates.

The results of such a micro-study are more immune to alternative interpretations since any competing story must account for the observed patterns of investment over time, and for any *differential* response of firms to monetary policy. If, for example, we find that tight money reduces firm-level investment but the investment of export-intensive firms is affected less, an explanation of the patterns of investment over time must account for the different behavior of export-intensive firms. It is more difficult to formulate such explanations, but not impossible. In our analysis, we address two potential alternatives to the balance sheet effect. One is centered on the indirect impact of monetary policy on investment through its effect on the exchange rate. The other stresses the effect of monetary policy on the demand that firms face and the ensuing effect on investment. We provide evidence that strongly suggests that these mechanisms are not the driving force behind the observed patterns of firm-level investment, and conclude that supply-side balance sheet effects are the most probable explanation for the empirical findings.

III. Theories of Firm-Level Investment

We briefly survey four major theories of investment, all potentially relevant for explaining firm-level investment in fixed assets.[21]

The accelerator

The accelerator model, associated with Paul Samuelson, assumes that firms hold capital stock (K) proportional to the level of output (Y). That is, $K = v * Y$ where v is a parameter reflecting the capital/output ratio that firms wish to maintain. Thus, $I = (\Delta K) = v * \Delta Y$, where I denotes investment. The most straightforward interpretation is that K represents factors of production such as plants and equipment, and that v is a technological parameter. A similar interpretation may apply to investment in inventories of raw materials and intermediate goods that are used in the production process, but not to inventories of finished goods.

Tobin's q

According to q theory, associated with James Tobin (1969), firms base their investment decisions on the ratio of market value of their capital - as valued by the stock market - and the price of the capital if it were purchased today (replacement cost). If this ratio (Tobin's q) exceeds one, more capital will be installed. As in the accelerator model, the most natural interpretation is that the theory applies to investment in plants and equipment (and maybe also in inventories of raw materials and intermediate goods) since these investment items affect the productive capacity of the firm.

[21] Most of these theories are less relevant for investment in inventories.

The cost of capital

According to this theory (see, e.g., Jorgenson 1996), a firm's decision whether to add to its capital stock or let it depreciate depends on the difference between the cost of capital and its marginal product. As long as the marginal cost of capital exceeds its rental or opportunity cost there will be investment. An increase in the real interest rate raises the cost of capital and reduces investment.

For many investments, the relevant cost of capital is the long-term interest rate. In this study, as in others related, we are not interested in the effect of long-term rates on investment. Rather, we want to gauge the potential effect of monetary policy - proxied by short-term rates - on firm-level investment. Short-term rates may affect investment in the presence of capital market imperfections because firms may have limited access to long-term funds and must finance investment with short-term loans. Another possibility is that short-term rates have a direct effect on long-term rates (e.g., by affecting the public's expectations regarding long-term rates in a self-fulfilling manner).[22,23]

Capital market imperfections

Often, firms face financing constraints that can prevent them from undertaking profitable investments. These constraints can arise from capital market imperfections due to asymmetric information. For example, young unknown firms cannot raise funds by issuing securities on anonymous markets and therefore tend to raise funds from banks that provide screening and monitoring services (see, e.g., Fama 1985 and Diamond 1991). In such situations financing constraints induce firms to determine their investment on the basis of their cash flow rather than on expected future profits. Indeed, numerous studies following Fazzari,

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[22] Hall (1977) suggests that short-term rates may mainly affect the timing of investment.

[23] For the sake of robustness, we also ran regressions that include the long-term rate. Our main concern is the edogeneity of long-term rates. We briefly report the results in the text, but not in tables.

Hubbard, and Petersen (1988) have found that cash flow and other financial variables are positively associated with investment at the firm level.

IV. The Data

The sample and the data sources

Our sample consists of all the manufacturing firms that are listed on the Tel Aviv Stock Exchange (TASE).[24] We follow the sample for 8 years, from 1991 to 1998. Almost two thirds of the firms in the sample went public during the 1990s. Virtually all heavily use bank credit, while almost none issued publicly traded corporate debt or commercial paper.[25] Approximately 20 Israeli firms are listed dually, in Tel Aviv and in the US, of which 12 firms are included in our sample.

We collected data from several key sources: (1) financial statements, obtained mostly from a Compustat-type database ("Dukas") compiled by the TASE from annual reports; (2) stock price data (for the calculation of Tobin's q); and (3) flow statements compiled by the Bank of Israel Research Department from annual reports. In addition, we collected data on firm age (mostly from firm prospecti).

Flow of Funds charts

The Research Department at the Bank of Israel has collected the 1991 through 1998 Annual Reports for listed firms and entered by hand for each firm and each year the "Consolidated Statement of Flows." The statement decomposes flows into three key components: flows derived from operating activities, investment activities, and financing

[24] In the official TASE classification by industry, the category "manufacturing" includes venture capital firms and holding companies. To preserve the (relative) homogeneity of the sample, these firms are omitted.

[25] In 1998, the firms in our sample constituted 36 percent in terms of sales income of the entire manufacturing sector (publicly traded and privately held firms).

activities, broken down into about 50 sub-entries.

We focus on investment activities. Since firms report the current value of their investment purchases, imprecision that arises when standard financial statements are used is avoided. For example, if only profit and loss, and balance sheet, statements are available, only net investment can be calculated to which economic depreciation must be added. Such imputation does not take into account vintage effects and price changes. The flow statements also allow us to control for information that cannot be obtained easily from standard financial reports. For example, for each firm-year we construct the variable "Govshare" - the share of government-provided sources out of total sources (total sources = flow from retained earnings + external funding). Since many firms receive government subsidies for investment in fixed assets it is essential to control for such subsidies in the empirical analysis.[26]

From the detailed flow reports we construct firm-level year-by-year Flow of Funds charts. Such data are ideal for our purpose since they include high quality information on investment expenditure as well as relevant financial information.

We focus on two types of investment: (1) investment in fixed assets,[27] that includes investment in property, plants, and equipment (net of sales of these items); these expenditures

[26] Government subsidies are distributed mainly to firms operating in peripheral areas and to firms that perform R&D. In our sample, "Govshare>0" not only for firms located in the periphery.
[27] This item is sometimes referred to as "capital expenditure."

increased significantly during most of the 1990s before declining in 1995;[28] and (2) investment in inventories, defined as outlays for raw materials not yet used in the production process plus the net change in the stock of finished goods

Removing outliers

We removed from the sample firm-year observations in which we identified inconsistencies between the Dukas database and the flow statements entered by hand.[29] In this procedure, we used four key variables: net profits, cash from investment activities, cash from financial activities, and cash from operations. A discrepancy of 5 percent (provided it is greater than 5000 December 1990 NIS) in one or more of these variables led to the removal of the firm-year observation from the sample. The number of firms in our sample, after removing the outliers, increases from about 45 in 1991 to over 130 in 1998.

Calculating Tobin's q

We measure average Tobin's q as the market value of assets divided by their replacement value. Replacement values are calculated assuming that fixed assets and inventories appreciate at a rate equal to that of the Consumer Price Index (CPI). The market value of assets equals the market value of common equity (obtained directly using stock price data) plus the value of debt and other liabilities. Since debt is mostly not traded, we estimate

[28] We compared the rates of growth according to our data and those reflected in the two Central Bureau of Statistics (CBS) databases that cover all (publicly traded and privately held) manufacturing firms: the Industry and Crafts Surveys, and the National Accounts Data. (The latter is derived primarily from figures on imports of machines as well as aggregate construction figures, while the Industry and Crafts Surveys, published with a lag by the CBS, is derived, somewhat similarly to our data, from information reported by individual firms.) Although the CBS methodologies and definitions are different from ours (as well as being different among themselves) and the weights of different industries are not the same, the general trends in the two CBS databases are consistent with our data, exhibiting sharp increases in the early years, and then recording a slowdown in 1996 and 1997.

its value by subtracting from the replacement value of the assets the sum of the book value of common equity and (CPI adjusted balance sheet) deferred taxes and employee benefits. Tobin's q so calculated rises dramatically in 1992 and 1993, reflecting the stock price run-up in those years, and then declines precipitously to an average of 0.93 in 1996. In 1997, however, market conditions improved and market value becomes as large as replacement value.

Short-term interest rates

We use two measures of the real short-term interest rate: (1) the marginal rate on monetary loans to commercial banks announced monthly by the Bank of Israel; and (2) a weighted average (across banks) of the interest rate on non-indexed overdraft for businesses, both deflated by inflation expectations.[30] These expectations are constructed by calculating the yield differential on non-indexed and indexed tradable Israeli government bonds of the same maturity. As already mentioned, we use mainly real interest rates but we repeat some regressions using the nominal interest rate and inflation expectations as separate regressors.[31] All the series are obtained from the Bank of Israel databases.

Export intensity

Publicly traded firms are required to disclose their export income if it exceeds 10 percent of their total sales income. Otherwise, publishing this information is optional. In our sample, the export income is not reported in 36 percent of the firm-year observations. For these firms, we know that the true value of their export income share lies between 0 and 10 percent.

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[29] Further details can be found in Blass and Yosha (2000); an English version will be available in the near future.

[30] The yearly rates are computed by the Bank of Israel as geometric means of monthly rates.

[31] For the sake of robustness, we verified that the results do not change when a third measure of the interest rate is used (denoted by the Bank of Israel as the interest rate on "other short-term credit.")

Descriptive statistics and sample selection

Table 1 displays descriptive statistics of the entire sample and of sub-samples constructed according to export intensity. There are no meaningful differences in age, profitability, and leverage across export intensity groups but firms with high export intensity are considerably larger.[32] Within the low (< 10) export intensity group there are differences in several variables: age, size and, to some extent, profitability and leverage.[33] In the regression analysis, we control for all the firm characteristics in Table 1. For firms that do not report their export income share, we assume that is 0. We also split the sample into two groups - firms with low (< 10) and high (> 10) export intensity - comparing the effect of monetary policy on investment across these groups. This method yields qualitatively similar results suggesting that no serious bias is caused by export income reporting practices. No outliers were removed on the basis of the export income share.

Our sample includes virtually the entire population of publicly traded manufacturing firms so, in this respect, it is immune from selection bias. Moreover, during the sample period there have been virtually no bankruptcies or de-listings so survivorship bias is not a concern. In 1998, the firms in our sample constituted 36 percent in terms of sales income, of the entire manufacturing sector (publicly traded and privately held firms).[34] In 1998, the average export intensity in our sample is 28 percent while in the entire manufacturing sector it is 31 percent. Our focus on publicly traded firms is not necessarily a drawback for our analysis: if tight money reduces the real investment of (some) *publicly* traded firms, it should *a fortiori* affect

[32] Leverage may proxy for "bank dependence" (since virtually all corporate debt in Israel's manufacturing sector is bank debt). Thus, we have some indication that bank-firm ties do not vary systematically with export intensity.

[33] In a probit analysis for the low (<10) export intensity group where the dependent variable is 1 if the firm reports its export income, only age and size are significant (not displayed).

[34] Moreover, our sample includes 36 of the 50 largest manufacturing firms in Israel.

the investment of privately held firms that are on average younger, smaller, less well known, have fewer opportunities for non-bank financing, and are more likely to face liquidity constraints and credit rationing.

V. Empirical analysis

The basic regression

In our basic empirical specification, the left-hand variable is the ratio of investment to lagged fixed assets, I_t / K_{t-1}, where I denotes investment in fixed assets (the first and second columns of Table 2a) or in inventories (the third and fourth columns). We include several right-hand variables. Liquidity is measured as the ratio of the change in cash holdings to sales income, and leverage as the ratio of debt to total assets. Both are included as controls for potential credit market imperfections and liquidity constraints. The variable "Govshare" - the share of government-provided sources out of total sources (as calculated in the Flow of Funds charts) - is included to control for government investment subsidies to firms in peripheral areas of the country. We further include the percentage change in sales income to control for potential "accelerator" effects, and lagged Tobin's q, lagged firm size measured as log-assets,[35] lagged profitability measured as the ratio of profits to sales income, and industry dummies. Finally, we include the lagged value of the variable "Export share" which is central for testing our hypothesis that export intensive firms are affected less by tight money.[36]

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[35] The regression results are virtually unchanged if size is included as assets (rather than log-assets). Since the distribution of this variable in our sample is quite skewed, we generate a "bell-shaped" distribution using a log-transformation.

[36] In columns numbered (1), we "Export share" denotes the log of one plus the share of export income out of sales income. We use a log-transformation in order to reduce the skewness of this variable. A drawback of the log-transformation is that interpreting the magnitude of the coefficient is harder. In columns numbered (2), we use the non-transformed "Export share" variable, obtaining qualitatively similar results.

In the regressions displayed in Table 2a, we use the weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses as our measure of monetary policy. We include the interest rate both as a stand-alone regressor, and interacted with other variables. For example, the coefficient of the interaction of the interest rate and firm-level liquidity indicates whether monetary policy affects differently the real investment of firms that have more liquid assets. [37] Most relevance for our study is the coefficient of the interaction of the interest rate and "Export share." The estimated coefficient associated with this variable indicates whether export intensive firms are affected differently by monetary policy. In the reported regressions, all the right-hand variables are lagged, reflecting that investment decisions typically take time to mature and are often implemented with delay.

The regressions in Table 2a are estimated using OLS and are corrected for heteroskedasticity.[38] In these regressions we do not include firm-fixed effects since some variables exhibit very little variation over time. Later, we report regressions with firm-fixed effects that yield similar results.

Geographic location as an instrument for "Govshare"

Since government investment subsidies are potentially endogenous for firm-level investment, we instrumented the variable "Govshare" with a dummy variable that takes the value 1 if all the firm's plants are in peripheral areas that qualify the firm for such investment subsidies. In all the specifications, the results are virtually identical whether this dummy variable is used as an instrument for "Govshare" or not. In the tables, we report the results of regressions without this dummy variable as an instrument.

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[37] Including such variables, as stand-alone regressors *and* interacted with the interest rate, in the same regression is not advised due to high colinearity since the interest rate varies only over time but not across firms.

[38] We use White's correction for hetroskedasticity. Later, we report results with a different correction for heteroskedasticity, with similar results.

Results

The coefficient of the lagged interest rate is robustly negative and significant in all the regressions.[39] The coefficient of the interaction between the short-term interest rate and "Export share" is positive and significant confirming our central hypothesis that monetary policy affects the investment of export intensive firms less.

The magnitude of the negative effect of the lagged interest rate on investment is substantial. Consider, for example, the regression displayed in the second column of Table 2a where "Export share" is not log-transformed. The coefficient of R(-1) indicates that for a firm that does not export ("Export share(-1)" = 0), an increase of one percentage point in the interest rate on short-term credit reduces (other things equal) the ratio of investment to fixed assets by 1.4 percentage points which is about 4.6 percent of the mean investment share in the sample. The coefficient of "R(-1) * Export share(-1)" indicates that for a firm that only exports ("Export share(-1)" = 1), an increase of one percentage point in the interest rate on short-term credit reduces the ratio of investment to fixed assets by only 0.27 percentage points (-1.4 plus 1.13), namely the estimated average negative effect of the interest rate is almost fully offset. The average value of "Export share" is 0.23. For this "average firm," the net effect of an increase of one percentage point in the interest rate is -1.14 percentage points (-1.4 plus 0.23*1.13), namely, the offsetting effect due to export sales income is about 20 percent. For investment in inventories (the fourth column of Table 2a), the order of magnitude

[39] This finding is consistent with work by Lavi (1990) who uses aggregate Israeli investment data for the period 1962-1988 and finds a negative and significant effect of the short-term interest rate on investment.

of these coefficients is similar. An analogous calculation can be performed for the regressions where “Export share” is log-transformed yielding a similar offsetting effect of about 20 percent for a firm with the average value of “Export share.”

We turn to the other regressors. For investment in fixed assets, we find a positive and significant coefficient for the interaction of liquidity and the interest rate. Namely, the interest rate affects less the investment in fixed assets of firms that have more liquid assets. This constitutes support for theories of investment based on capital market imperfections. However, as we will see later, this result is not robust across all specifications. Of course, liquidity constraints are potentially more important for privately held firms, so the inconclusive results concerning this variable for our sample of publicly traded firms are not surprising.

The results indicate quite strongly that younger and smaller firms invest less as a fraction of fixed assets, which is *not* consistent with the idea that young firms invest more in order to grow. This is most likely due to the fact that all the firms in our sample are mature firms.

The regressions do not provide evidence that firms with high leverage are more influenced by tight money, and that those with government support are less sensitive to short-term interest rates. The industry dummy variables are typically not significantly different from zero. We also tried to interact them with the interest rate in order to detect industries that are more affected by tight money finding no significant coefficients.

Finally, the estimated coefficients provide empirical support for other theories of investment. We find that the lagged percentage change in sales income (a proxy for the change in the level of production) affects investment positively and significantly which is

consistent with the accelerator theory of investment. We also find support for q theory: Tobin's q affects positively investment in fixed assets, but not investment in inventories. This is perfectly sensible since investment in fixed assets is a better proxy for the expansion of productive capacity than investment in inventories.[40]

We repeated the analysis using current (rather than lagged) variables as regressors. All the coefficients were very similar except the coefficient of the current interest rate which was not significantly different from zero. This probably reflects the lagged response of investment to changes in factor prices, e.g., due to the fact that the investment taking place in a given year is largely the consequence of irrevocable decisions made in earlier years; see Jorgenson (1996).

Dually traded firms

We ran the same regressions including an additional regressor – the interaction of the lagged interest rate with a dummy variable that indicates whether a firm is dually traded (in Tel Aviv and New York). We did so both in addition and instead of "Export share" and found that the effect of monetary policy on the investment of dually listed firms is significantly lower. As mentioned above, these firms exhibit higher than average export intensity so this result is not surprising. Since dually listed firms are special in many respects, we removed them from the sample and repeated the regressions in Table 2a obtaining virtually identical results. We do not pursue this issue further.

[40] It is worth recalling that q theory is based on the notion that *all* relevant information is captured in market valuation and, therefore, other variables such as liquidity and profits should have *no* explanatory power for investment. Our results do not go as far this.

Robustness

Table 2b displays similar regressions with the dependent variable (investment) normalized by lagged sales income rather than by fixed assets. In columns numbered (1) we use a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses as a measure of the short-term interest rate. In columns numbered (2) we use instead the rate on monetary loans to commercial banks announced monthly by the Bank of Israel. In all the regressions we use the log-transformed "Export share" (the log of one plus the share of export income out of sales income). We experiment with specifications where the variables liquidity, leverage, and "Govshare" are included as stand-alone regressors and with specifications where they are interacted with R(-1).

The results are similar to those in Table 2a. In particular, the coefficient on R(-1) is negative in all the columns, and significant in most, while the coefficient of "R(-1) * Export share(-1)" is positive and significant in all the columns. The magnitude of the reduction in the effect of R(-1) on investment for a firm that has an average "Export share" varies across the columns. For example, for the first column the reduction is about 80 percent, for the fifth column it is 16 percent, but for the second column it exceeds 90 percent. Summarizing, it is evident from these additional regressions that the real investment of export intensive firms is affected much less by domestic monetary policy, but pinning down the exact magnitude of this effect is difficult.

In Table 2c we perform similar regressions using the nominal interest rate and inflation expectations as separate regressors. The results are overall similar, and the coefficients on the nominal interest rate and on inflation expectations are virtually equal, which is consistent with the fact that merging these variables into a single one (the real interest rate) yields very similar results.

In Table 2d we perform similar regressions using GLS where the data are weighted by

log-assets. (We do not further correct the residuals for heteroskedasticity.) The results are almost identical to those displayed in Table 2a.

In Table 3, we report regressions for two sub-samples - export intensive firms and non-exporting firms.[41] This specification is more transparent since the results do not depend on the coefficient of the non-linear variable "R(-1) * Export share(-1)." Its main disadvantage is the smaller sample size. The results are consistent with previous tables, and are quite sharp: tight monetary policy negatively affects the investment of firms with low export intensity, but has no effect on the investment of for export intensive firms.[42]

In Table 4, we allow for firm-fixed effects. For each variable and every firm-year, we subtract the mean of the variable over time for the corresponding firm. We do this for leverage, liquidity, size, profitability, and Tobin's q. We include firm age, the interest rate, and (in the second column of the table) its interaction with "Export share" as regressors. The estimated coefficients on the interest rate and its interaction with "Export share" are very similar to those in previous tables, and the other coefficients are qualitatively similar as well.[43]

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[41] Non-exporting firms are defined as firms with export income share less than 10 percent.

[42] Notice that in this specification "Export share" is included as a stand-alone regressor.

[43] We also performed these regressions with industry dummies. The coefficients of these dummy variables control for potential industry-specific linear trend growth in the left-hand variable (investment). The inclusion of these dummy variables has no effect on the estimated coefficients, and the coefficients on these variables are not significant. We also ran a specification with a constant (capturing a linear trend growth in the left-hand-side variable) with virtually identical results.

Other measures of liquidity

Until now, we measured liquidity as the ratio of the change in cash holdings to sales income. Bernanke, Gertler, and Gilchrist (1996) use the coverage ratio - the ratio of current assets to current liabilities - as an alternative measure of liquidity. We estimated several specifications with this measure, instead, obtaining virtually identical results (not shown).

Exchange rates

Tight monetary policy is associated with high domestic interest rates that induce capital inflows which, in turn, appreciate the domestic currency. This, on the one hand, depresses exports and may, as a result, reduce the real investment of export oriented firms. An appreciated currency also renders imports less expensive, including imports of investment goods, which should induce firms to increase investment expenditures (Goldberg and Campa, 1995, 1999). To control for such effects, we included the (year-by-year) nominal exchange rate (the price of a US dollar in terms of the domestic currency) and the real exchange rate, measured as the ratio of the export price index to the GDP deflator.[44] The results are displayed in Table 5. The coefficients on the nominal and real exchange rate are not significantly different from zero, and the other coefficients are virtually unaffected. We also included the rate of change of the nominal and real exchange rates, with identical results (not shown). It seems, therefore, that our results are not driven by the effect of monetary policy on nominal or real exchange rates.

As a further check, we calculated the interest rate spread between the domestic short-term interest rate and two proxies of the "foreign" short-term rate (the US Federal Funds rate and the 3-months Eurobond rate) adjusted for the change de facto in the relevant nominal

[44] Campa and Goldberg (1995, 1999) study the effect of exchange rate fluctuations on investment at the industry level for the US, controlling for industry-specific imported input shares. The data

exchange rate. We included this variable as an additional regressor and found it not significant without materially affecting any of the other coefficients.[45]

Long-term rates

Often, the relevant cost of capital is the long-term interest rate. This rate is clearly determined in market equilibrium (and hence is endogenous). Neverheless, we ran our main specifications with the yield on 10-year government tradable bonds, as well as specifications with the medium-term indexed bank debt as additional regressors. Their coefficients are not significant, and their inclusion does not meaningfully affect the coefficients and significance levels of the other regressors. When the short-term rate is ommitted from the regression, the coefficients on the long- (or medium-) term rate become negative and significant. This indicates that the long- and the short- term rates are correlated (through the yield curve) and that most of the variability in long-term rates is due to variability in short-term rates.

Demand-side effects

Tight money may reduce domestic demand. Export intensive firms can better compensate for the decline in domestic demand by shifting marketing and sales activities to export markets. As a result, export intensive firms should be less sensitive to domestic monetary policy. To address this possibility, we check whether export intensity varies with aggregate variables that proxy for changes in domestic demand. The first column of Table 6a displays a regression of firm-by-firm and year-by-year "Export share" on firm characteristics,

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necessary for computing imported input shares at the firm level or at the manufacturing sub-industry level are not available.

[45] It is well documented that interest parity does not hold in the short run, so we are reluctant to interpret this spread as a measure of the expectations for a depreciation of the domestic currency. The reason that this spread does not affect the invesment of export intensive firms (in regressions that control for fluctuations in the domestic rate) may be that fluctuations of the US Federal Funds rate and the 3-months Eurobond rate during the sample period were too small to have a detectable effect.

GDP growth, the nominal exchange rate, and the lagged interest rate. We find that "Export share" does not vary with GDP growth nor with the lagged interest rate which is not consistent with the interpretation that firms shift sales activity to export markets in response to a lower domestic demand induced by tight money.[46]

It may be that export intensive firms do not *shift* sales activities to foreign markets during periods of tight money yet are less affected by fluctuations in domestic demand simply because part of their income depends on demand overseas. In that case, their *domestic* sales should respond to the domestic interest rate whereas their *export* sales should not. To check this, we regressed the domestic and export sales of the export intensive firms in our sample on the lagged interest rate, controlling for firm characteristics; see the third and fourth columns of Table 6a. We find that neither domestic nor and export sales respond to tight money, which is not consistent with this interpretation.

Moreover, the sales of the non-export intensive firms exhibit a negative and significant reponse to the lagged interest rate - see the second column of Table 6a - which is consistent with the supply-side interpretation that there is a balance sheet effect of tight money that operates more strongly on the investment of firms that have less access to foreign currency denominated credit.

As an additional check, we performed the regressions of Table 2a controlling for GDP growth (see Table 6b) obtaining virtually identical results and an insignificant coefficient on GDP growth. We also used aggregate consumption growth as an alternative control for demand obtaining the same results (not shown). This constitutes further evidence that monetary policy is not transmitted through domestic demand.

Alternatively, it may be that since the export destinations of the firms in our sample vary, different firms respond to different "foreign" rates.

[46] If non-exporting firms are omitted from this regression, the results are similar.

Discussion: potential endogeneity of monetary policy

We argued that for the time period under consideration, the Bank of Israel's monetary policy is likely to be exogenous to real economic activity. It is nevertheless useful to understand what are the implications if this fails to be true. Obviously, bias in the estimated coefficients arises, but two points are worth mentioning. First, the bias in the coefficient on the interest rate is likely to be *upward*. To see this, suppose that the Bank of Israel reduces the interest rate in response to negative shocks to investment. This creates a positive correlation between investment and the real interest rate, and the negative effect of the interest rate on investment that we obtained in all the empirical specifications may be *understated*.

Second, we have been mainly concerned with the differential response to monetary policy of export intensive versus other firms. The *difference* in the response is not in and of itself sensitive to the presence of bias, only to different degrees of bias according to the export intensity of firms. Such differential bias is hard to justify. For example, even if the Bank of Israel resoponded mainly to slowdowns in the non-exporting sector, it is not evident that a differential bias would be created since monetary policy would still affect firms in *all* sectors.[47,48]

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[47] Differential bias in the coefficient to the interest rate can arise through differential bias in the coefficients of other variables in the regression. This is unlikely in light of the robustness of the results across specifications, and for several measures of the interest rate and of investment.

[48] Djivre and Ribon (2000) estimate a dynamic system using quarterly macro-level data for the Israeli economy. They find a negative relation between the Bank of Israel's nominal monetary interest rate and gross domestic product, which is consistent with our results (monetary policy negatively affects real activity). However, they also report a negative relation between the Bank of Israel's nominal monetary interest rate and the estimated "output gap." If, indeed, the Bank of Israel responds to the "output gap," our discussion of potential bias is highly relevant. It cannot be ruled out, though, that this negative relation is created as follows: the Bank of Israel responds to nominal variables and inflation expectations (as we believe to be the case); these, in turn, are correlated with real activity resulting in a correlation of the interest rate and measures of real activity. (For example, if high inflation expectations entail both a reduction in real activity and - independently - a rise in the Bank's interest rate, we will see in the data a negative relation between the interest rate and real activity).

VI. Conclusion

We provided evidence indicating that monetary policy is transmitted through the balance sheets of firms that have less access to foreign currency denominated funds. The increased globalization of markets should render such a finding of interest to researchers and policy makers since it implies that monetary policy has real effects even in a liberalized and open economy, although these real effects should be smaller the more open the economy. Of course, our study focuses on the short-term effect of the interest rate on investment, and does not attempt to evaluate the long-term benefits of lower inflation through tight monetary policy.

Table 1

Descriptive Statistics

Exports as a share of total sales (%)	Percent of observations	Age	Profitability	Size	Tobin's q	Leverage
<10	56	31	7.4	38.9	1.12	0.86
of which:						
reporting	20	41	8.3	73.0	1.13	0.97
not reporting	36	24	7.1	32.7	1.10	0.81
>10 and <50	20	24	6.7	48.5	1.03	0.73
>50 and <80	12	31	6.7	39.8	1.09	0.76
>80	12	26	8.8	77.2	1.15	0.78
All firms	100	28	7.4	44.2	1.10	0.80

Publicly traded firms are required to disclose their export sales income if it exceeds 10 percent of their total sales income. Otherwise, publishing this information is optional. The displayed numbers are based on averages over the sample period. "Age" is the number of years since incorporation. "Profitability" is the ratio of operating profits to sales (in percent). "Size" is the firm assets (in million 1997 NIS). "Tobin's q" is the market value of assets divided by their replacement value. "Leverage" is total debt divided by liabilities.

Table2a
The Effect of Monetary Policy on Investment
Scaled by Fixed Assets (I_t/K_{t-1})

	Investment in fixed assets		Investment in inventories	
	(1)	(2)	(1)	(2)
Mean of the dependent variable	30.7		6.4	
Intercept	53.4 3.7*	54.7 3.8*	32.4 2.7*	31.8 2.2*
Sales income change (%)	0.13 2.5*	0.13 2.4*	0.22 3.9*	0.21 3.8*
Tobin's q (-1)	12.0 4.6*	11.9 4.6*	2.7 1.4	2.6 1.3
R(-1)	-1.4 -2.7*	-1.4 -2.7*	-1.9 -3.1*	-1.8 -3.0*
R(-1)* Export share(-1)	3.3 2.4*	1.13 2.4*	4.0 2.5*	1.14 2.3*
R(-1)* Leverage(-1)	-0.8 -0.2	-0.7 -0.2	-1.7 -1.0	-1.6 -0.9
R(-1)* Liquidity(-1)	4.2 2.6*	4.0 2.4*	2.0 0.9	.8 0.9
R(-1)* Govshare(-1)	-0.7 -1.0	-0.7 -1.0	-0.3 -1.1	-0.3 -1.1
Age	-0.15 -2.25*	-0.16 -2.3*	0.12 1.5	0.12 1.5
Size(-1)	-2.2 -2.2*	-2.3 -2.3*	-2.3 -2.0*	-2.2 -1.9*
Profitability(-1)	0.24 1.8**	0.25 1.9**	0.5 3.7*	0.5 3.7*
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.197	0.197	0.100	0.097
N	772	772	774	774

In column numbered (1) "Export share" is the log of one plus the share of export sales income out of total sales income, and in column (2) "Export share" is the level of the share of export sales income out of total sales income. "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total sources. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table2b
The Effect of Monetary Policy on Investment: Robustness

	Investment normalized by fixed assets				Investment normalized by sales			
	Investment in fixed assets		Investment in inventories		Investment in fixed assets		Investment in inventories	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Mean of the dependent variable	30.7		6.4		8.9		0.5	
Intercept	53.9 3.8*	42.0 3.1*	32.4 2.7*	19.1 1.4	16.0 3.1*	11.0 2.2*	4.6 2.3*	2.4 1.2
Sales income change (%)	0.1 2.5*	0.14 2.5*	0.22 3.9*	0.2 4.2*	0.03 1.2	0.03 1.3	0.04 4.5*	0.04 4.4*
Tobin's q (-1)	11.9 4.5*	12.4 4.6*	2.7 1.4	2.8 1.5	1.2 1.74**	1.3 1.9*	0.3 0.9	0.4 1.4
R(-1)	-1.4 -2.8*	-1.2 -2.4*	-1.9 -3.1*	-2.4 -4.2*	-0.56 -3.0*	-0.3 -1.6	-0.36 -4.2*	-0.3 -3.1*
R(-1)* Export share(-1)	3.3 2.3*	10.7 2.8*	4.0 2.5*	6.9 1.9**	0.96 2.1*	3.0 2.3*	0.53 2.2*	1.5 2.2*
R(-1)* Leverage(-1)		0.2 0.04	-1.7 -1.0	-3.3 -0.9		0.14 0.12		-0.2 -0.3
R(-1)* Liquidity(-1)		7.1 1.3	2.0 0.9	0.4 0.1		0.5 0.2		-0.6 -1.0
R(-1)* Govshare(-1)		-2.7 -1.4	-0.3 -1.1	-1.1 -1.3		-0.5 -1.0		0.01 0.07
Leverage(-1)	-12.8 -0.4				-4.8 -0.5		-4.8 -0.8	
Liquidity(-1)	43.4 2.6*				5.9 0.7		-1.5 -0.7	
Govshare(-1)	-6.7 -1.0				-0.8 -0.5		0.1 0.2	
Age	-0.15 -2.4*	-0.16 -2.1*	0.12 1.5	0.08 0.9	-0.07 -3.9*	-0.08 -3.8*	-0.02 -1.0	0.009 0.8
Size(-1)	-2.2 -2.2*	-2.1 -1.9*	-2.3 -2.0*	-1.9 -1.6	-0.2 -0.5	-0.15 -0.4	-0.2 -1.4	-0.3 -1.8**
Profitability(-1)	0.23 1.7**	0.3 2.0*	0.5 3.7*	0.5 3.5*	0.13 2.8*	0.13 3.1*	0.1 4.0*	0.1 3.8*
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R-squared	0.202	0.189	0.100	0.099	0.099	0.089	0.104	0.095
N	772	772	774	774	772	772	774	774

Notes on next page

In columns numbered (1) "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses as a measure of the short-term interest rate. In columns numbered (2) "R" is the rate on monetary loans to commercial banks announced monthly by the Bank of Israel. "Export share" is the log of one plus the share of export sales income out of total sales income. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total sources. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 2c
The Effect of the Nominal Interest Rate on Investment

	Investment in fixed assets		Investment in inventories	
	(1)	(2)	(1)	(2)
Mean of the dependent variable	30.7		6.4	
Intercept	50.4 3.6*	51.1 2.7*	22.9 1.6	43.4 2.4*
Sales income change (%)	0.13 2.5*	0.13 2.6*	0.2 3.8*	0.2 3.9*
Tobin's q (-1)	12.2 4.5*	11.7 3.7*	3.4 1.6	1.0 0.4
Infexp(-1)	1.2 2.0*	0.46 1.1	1.97 2.9*	1.4 2.9*
R(-1)	-1.15 -2.4*	-1.0 -1.3	-1.4 -2.6*	-2.7 -3.1*
R(-1)* Export share(-1)	1.2 2.0*	2.0 2.2*	1.7 2.5*	2.8 2.6*
R(-1)* Leverage(-1)	-0.5 -0.4	-0.7 -0.4	-0.9 -1.1	-1.4 -1.3
R(-1)* Liquidity(-1)	2.0 2.7*	3.0 2.6*	1.0 1.0	1.5 1.0
R(-1)* Govshare(-1)	-0.3 -0.9	-0.5 -1.0	-0.14 -1.1	-0.2 -1.2
Age	-0.15 -2.3*	-0.15 -2.3*	0.13 1.6	0.13 1.6
Size(-1)	-2.1 -2.1*	-2.3 -2.3*	-2.3 -2.0*	-2.6 -2.3*
Profitability(-1)	0.2 1.7**	0.2 1.5	0.5 3.7*	0.5 3.7*
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.197	0.194	0.100	0.104
N	772	772	774	774

In columns numbered (1) "R" is a weighted average (across banks) of the *nominal* interest rate on non-indexed overdraft credit to businesses as a measure of the short-term interest rate. In columns numbered (2) "R" is is the *nominal* rate on monetary loans to commercial banks announced monthly by the Bank of Israel. “Infexp” denotes inflation expectations calculated from the yield differential on tradable non-indexed and indexed government bonds of the same maturity. "Export share" is the log of one plus the share of export sales income out of total sales income. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total sources. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table2d

The Effect of Monetary Policy on Investment:
Regressions Weighted by Log-Assets

	Investment in fixed assets		Investment in inventories	
	(1)	(2)	(1)	(2)
Intercept	48.4 3.9*	49.7 4.0*	29.7 2.3*	29.1 2.3*
Sales income change (%)	0.14 3.0*	0.13 2.9*	0.21 4.6*	0.21 4.6*
Tobin's q (-1)	12.4 7.6*	12.3 7.5*	2.7 1.5	2.5 1.4
R(-1)	-1.16 -2.3*	-1.15 -2.3*	-1.8 -3.5*	-1.8 -3.3*
R(-1)* Export share(-1)	3.6 2.9*	1.2 3.2*	4.1 3.2*	1.1 2.9*
R(-1)* Leverage(-1)	-1.0 -0.3	-0.9 -0.3	-1.4 -0.5	-1.3 -0.5
R(-1)* Liquidity(-1)	3.8 3.4*	3.5 3.2*	2.2 1.8*	2.0 1.7**
R(-1)* Govshare(-1)	-0.8 -2.6*	-0.8 -2.6*	-0.4 -1.0	-0.3 -1.0
Age	-0.15 -2.4*	-0.16 -2.5*	0.1 1.5	0.1 1.4
Size(-1)	-2.0 -2.0*	-2.0 -2.1*	-2.0 -1.9*	-1.9 -1.8**
Profitability(-1)	0.2 1.4	0.2 1.5	0.5 3.6*	0.5 3.6*
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.187	0.186	0.100	0.097
N	772	772	774	774

In column numbered (1) we use "Export share" as the log of one plus the share of export sales income out of total sales income, and in column (2) we use the level of the export share. "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total sources. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 3
The Effect of Monetary Policy on Investment:
Export Intensive versus Other Firms

	Investment in fixed Assets	
	Export intensive	Other
Intercept	9.7 0.5	86.1 3.9*
Sales income change (%)	0.18 2.0*	0.08 1.1
Tobin's q (-1)	1.9 2.7*	10.7 3.7*
R(-1)	0.23 0.3	-2.1 -2.9*
Exportshare	0.20 3.2*	-0.005 -0.01
R(-1)*Leverage(-1)	-10.6 -2.1*	0.4 0.2
R(-1)*Liquidity(-1)	4.6 2.1*	4.1 1.8**
R(-1)*Govshare(-1)	-2.0 -1.6	0.3 0.9
Age	-0.39 -3.3*	-0.03 -0.4
Size(-1)	0.8 0.5	-4.7 -2.9*
Profitability(-1)	0.13 0.5	0.3 1.6
Industry dummies	YES	YES
Adjusted R-squared	0.25	0.182
N	326	446

"R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit as a measure of the short-term interest rate. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total (sales) income. "Govshare" is the share of government provided sources in total sources. "Export intensive" refers to firms with "Export share" larger than 10 percent of sales income. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 4

The Effect of Monetary Policy on Investment:
Allowing for Firm-Fixed Effects

	Investment in fixed assets	Investment in fixed assets	
		Export intensive	Other
Sales income change (%)	0.07 1.4	0.14 2.0*	0.03 0.3
Tobin's q (-1)	5.7 2.5*	6.4 2.1*	4.7 1.4
R(-1)	-0.56 -4.3*	-0.27 -1.9*	-0.4 -3.1*
R(-1)* Export share(-1)	0.88 2.4*	–	–
Leverage(-1)	4.5 0.4	-17.8 -1.1	12.8 0.8
Liquidity(-1)	24.7 1.8**	19.3 0.8	29.9 1.7**
Govshare(-1)	-10.1 -1.7	-16.7 -1.6	-4.2 -0.9
Size(-1)	-24.0 -4.5*	-10.4 -1.3	-34.7 -5.0*
Profitability(-1)	0.7 4.2*	0.7 2.6*	0.7 3.2*
Adjusted R-squared	0.125	0.131	0.119
N	772	326	446

We remove, for each firm and every variable, the mean over time of this variable. "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit as a measure of the short-term interest rate. "Export share" is the log of one plus the share of export sales income out of total sales income. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total source. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 5
The Effect of Monetary Policy on Investment:
Controlling for Changes in the Nominal and the Real Exchange Rate

	Investment in fixed assets		Investment in inventories	
	Nominal exchange rate	Real exchange rate	Nominal exchange rate	Real exchange rate
Intercept	54.1 3.0*	55.9 3.5*	39.2 2.2*	20.2 3.3*
Sales income change (%)	0.13 2.5*	0.13 2.5*	0.2 3.9*	0.03 1.3
Tobin's q (-1)	12.0 4.4*	12.2 4.4*	2.3 1.1	1.4 1.9*
R(-1)	-1.4 -2.7*	-1.4 -2.7*	-1.9 -3.1*	-0.5 -2.9*
R(-1)* Export share(-1)	3.3 2.4*	3.3 2.3*	4.0 2.5*	0.9 2.2*
Exchange rate	-0.2 -0.09	-0.03 -0.2	-1.9 -0.7	-0.05 -1.1
R(-1)* Leverage(-1)	-0.8 -0.3	-0.8 -0.3	-1.8 -1.0	-0.3 -0.3
R(-1)* Liquidity(-1)	4.2 2.6*	4.3 2.6*	2.0 0.9	-0.7 0.7
R(-1)* Govshare(-1)	-0.7 -1.0	-0.7 -1.0	-0.3 -1.1	-0.1 -0.5
Age	-0.1 -2.2*	-0.15 -2.3*	0.13 1.5	-0.08 -3.9*
Size(-1)	-2.2 -2.2*	-2.2 -2.1*	-2.4 -2.0*	-0.16 -0.4
Profitability(-1)	0.2 1.8**	0.2 1.8*	0.5 3.7*	0.13 2.8*
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.196	0.196	0.099	0.099
N	772	772	772	772

"R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses as a measure of the short-term interest rate. "Export share" is the log of one plus the share of export sales income out of total sales income. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total source. "Nominal exchange rate" denotes the (year-by-year) average domestic currency price of the US dollar. "Real exchange rate" is the ratio of the export price index to the GDP deflator. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 6a
The Effect of Monetary Policy and Aggregate Activity on the Export Share and on Sales Income

	Export share	Sales income change (%)		
		Other	Export intensive	
			Local sales	Export sales
Intercept	-83.7 -4.0*	20.0 0.9	-15.4 -0.4	-33.3 -0.2
Sales income change (%)	0.03 1.0	-	-	-
Age	-0.13 -2.1*	-0.18 -2.7*	-0.2 -1.4	-0.07 -0.2
Size(-1)	6.8 7.5*	0.6 0.5	0.3 0.2	2.0 0.4
R(-1)	0.8 1.0	-1.4 -2.0*	-0.2 -0.2	-1.4 -0.4
GDP	0.6 0.7	1.2 1.3	2.8 1.4	1.7 0.3
Exchange rate	3.8 1.3	-2.3 -0.8	4.1 0.6	11.7 0.7
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.282	0.05	0.005	0.00
N	774	446	323	323

In column numbered (1) we use "Export share" as the log of one plus the share of export income out of sales income, and in column (2) we use the level of the export share. "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total (sales) income. "Govshare" is the share of government provided sources in total sources. GDP is the annual growth rate of same year gross domestic product. "Export intensive" refers to firms with "Export share" larger than 10 percent of sales income. "Exchange rate" denotes the (year-by-year) average domestic currency price of the US dollar. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

Table 6b
The Effect of Monetary Policy on Investment:
Controlling for Changes in Aggregate Activity

	Investment in fixed assets		Investment in inventories	
	(1)	(2)	(1)	(2)
Intercept	54.6 3.7*	55.6 3.8*	36.8 2.3*	36.0 2.2*
Sales income change (%)	0.13 2.5*	0.1 2.4*	0.2 3.9*	0.2 3.8*
Tobin's q (-1)	12.1 4.3*	11.9 4.3*	2.9 1.4	2.8 1.4
R(-1)	-1.5 -2.4*	-1.4 -2.4*	-2.1 -2.8*	-2.1 -2.8*
R(-1)* Export share(-1)	3.3 2.4*	1.1 2.4*	4.0 2.5*	1.1 2.3*
GDP	-0.13 -0.2	-0.11 -0.1	-0.5 -0.5	-0.5 -0.5
R(-1)* Leverage(-1)	-0.8 2.8*	-0.7 -0.2	-1.6 -0.9	-1.5 -0.8
R(-1)* Liquidity(-1)	4.3 2.6*	4.0 2.4*	2.0 0.9	1.8 0.9
R(-1)* Govshare(-1)	-0.7 -1.0	-0.7 -1.0	-0.3 -1.1	-0.3 -1.0
Age	-0.1 -2.2*	-0.1 -2.3*	0.1 1.5	0.1 1.4
Size(-1)	-2.2 -2.2*	-2.2 -2.3*	-2.2 -1.9*	-2.2 -1.9*
Profitability(-1)	0.2 1.8**	0.2 1.9**	0.5 3.7*	0.5 3.6*
Industry dummies	YES	YES	YES	YES
Adjusted R-squared	0.196	0.196	0.099	0.096
N	772	772	774	774

In column numbered (1) "Export share" is the log of one plus the share of export sales income out of total sales income, and in column (2) "Export share" is the level of the share of export sales income out of total sales income. "R" is a weighted average (across banks) of the interest rate on non-indexed overdraft credit to businesses. "Sales income change" is the yearly percentage change in sales income. "Size" is the log of total assets. "Profitability" is the ratio of operating profits to sales income. "Leverage" is debt to total liabilities. "Liquidity" is the ratio of cash holdings to total sales income. "Govshare" is the share of government provided sources in total sources. GDP is the annual growth rate of same year gross domestic product. Top number is the estimated coefficient; bottom number is the t-statistic; "*" denotes significant at the 5% level; "**" denotes significant at the 10% level.

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