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# Financial development and firm growth in Turkish manufacturing industry: evidence from heterogeneous panel based non-causality test

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**ABSTRACT**

Inspired by the finance-led growth hypothesis at the aggregate level, this study predicates this hypothesis on microfoundations to investigate the causality between financial development and firm growth in Turkish manufacturing industry during the period 1989–2010. To this end, a recently developed non-causality approach proposed by Dumitrescu and Hurlin is applied. Empirical results in which heterogeneity and cross-sectional dependence are taken into consideration reveal the validity of a supply-leading hypothesis for the overwhelming majority of the subsectors. This result seems robust across the subsectors, regardless of the financial development proxy. On the other hand, there is also evidence that the results for the proxy of firm growth are not uniform across subsectors.

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## 1. Introduction

The contradictory views discussed in the context of a finance–growth nexus have become the major priority in the literature since the early 1970s. The question that has remained unanswered, however, is whether the policymakers should first pursue financial development or economic growth, or whether they should pursue both at the same time (Odhiambo, 2007). To solve this ambiguity in an empirical framework, causality techniques have been widely implemented. As noted by Kakilli-Acaravci, Ozturk and Acaravci (2009), in fact, causality between financial development and economic growth has been summarised into four hypotheses. First, the supply-leading hypothesis suggests a causality running from financial development to growth. This channel indicates that the financial system affects the real economy either through increases in saving rates and investments or efficiency improvements in capital accumulation (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973; King & Levine, 1993a, 1993b; Neusser & Kugler, 1998; Levine, Loayza, & Beck, 2000; among others). Second, the demand-following hypothesis suggests a causality running from economic growth to financial development. The expansion of an economy increases

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demand for financial services which, in turn, generates the creation of financial intermediaries (Demetriades & Hussein, 1996; Greenwood & Smith, 1997; Gurley & Shaw, 1967; Harrison, Sussman, & Zeira, 1999; Jung, 1986; Robinson, 1952; among others). Third, the feedback hypothesis brings the supply-leading and demand-following hypotheses together (Demetriades & Hussein, 1996; Gupta, 1984; Khalifa Al-Yousif, 2002; Shan, Morris, & Sun, 2001; among others). This interaction could exist even during the same period, which indicates that financial development contributes to economic growth, and this, in turn, induces further financial deepening. Moreover, the direction of causality may alter with respect to the general development level of the economy (Patrick, 1966; Thornton, 1996). Fourth, the irrelevance hypothesis asserts that financial development and economic growth are almost independent from each other. Financial development does not have a particular role in economic growth, or the impact can be ignored as argued by Lucas (1988) and Stern (1989), respectively. This view is consistent with neo-classical theory, which assumes zero transaction costs and perfect information (Blum, Federmair, Fink, & Haiss, 2002).

The relationship between financial development and growth is invariably investigated at the aggregate level. But we still do not know much about the empirical interaction between financial development and firms' growth, unlike the close linkage between the financial sector and firms. This study therefore attempts to provide micro-level evidence for the finance-led growth hypothesis. Given the abovementioned motivation, the purpose of this study is to investigate the causal relationship between financial development and firms' growth in Turkish manufacturing industry. To this end, we focus on seven subsectors over the period 1989–2010. The contribution of the existing study is threefold. First, it provides a new insight into the finance–growth nexus in Turkey within a micro framework. Second, it incorporates two different proxies for each variable to make a comparison between the proxies across the subsectors. Third, it employs a recently developed causality method, which takes heterogeneity and cross-sectional dependence into account.

The remainder of the study is set out as follows: Section 2 reviews the relevant literature; Section 3 describes the empirical model and data; Section 4 presents methodological issues and empirical findings; Section 5 discusses policy implications; and finally Section 6 concludes.

## 2. Literature review

The relationship between financial development and economic growth has been debated for over a century, both theoretically and empirically, dating back to Schumpeter (1911). This emerging literature includes broad cross-country growth regressions (Beck, Levine, & Loayza, 2000; Demirgüç-Kunt & Maksimovic, 2000; Khalifa Al-Yousif, 2002; King & Levine, 1993a, 1993b; among others), times-series analyses for multi-country cases (Arestis & Demetriades, 1997; Demetriades & Hussein, 1996; Rousseau & Wachtel, 1998; Shan et al., 2001; among others) and country case studies (Fritz, 1984; Hansson & Jonung, 1997; Wood, 1993; among others). In addition to the abovementioned studies, there are some recent empirical studies that use microeconomic data to investigate the relationship at either industry or firm level. Demirgüç-Kunt and Maksimovic (1998) use a sample of 30 countries over the period 1980–1991 to shed light on the relationship between the financial development of countries, industries and firms through their impact on the cost of external financing. They investigated whether countries with a less developed legal and financial

sector depict lower investment in profitable projects to growth. Their findings imply that in countries with better legal systems, more developed stock markets and larger banking sectors, a larger proportion of firms use long-term external finance to grow faster. Gallego and Loayza (2000), using 79 firms that were quoted on the stock market over the period 1985–1995 for Chile, found that an expansion of the real size and activity of the stock market appears to lead to higher firm growth. Using firm-level survey data that covers 44 countries for the period 1988–1997, Beck, Demirgüç-Kunt and Maksimovic (2003) found that there is a positive impact of the banking sector on firm size and an even stronger relationship for firms more dependent on external financing. In the case of 54 countries over the period 1995–1999, Beck, Demırgüç-Kunt and Maksımovıc (2005) imply that financial and institutional development facilitate firm growth, especially for small firms. Arellano, Bai and Zhang (2012) investigated the impact of cross-country variation in financial development on firms' financing choices and growth. Using comprehensive firm-level data from 27 European countries for the year 2004, they found that small firms grow faster and have lower leverage than large firms in less financially developed economies. Rajan and Zingales (1998) and Fisman and Love (2002) found that causality runs from financial development to industry growth. Guiso, Sapienza and Zingales (2004) analysed regional level data for Italian firms for the period 1989–1997 and found that financial market development facilitates corporate growth. Another study of Italian firms for the period 1995–2003 by Gagliardi (2009) shows that local financial development affects firm growth positively. In a recent paper examining the relationship between regional financial development and firm growth in the Peruvian manufacturing sector, Morón, Salgado and Seminario (2013) found a significant and positive impact of financial deepening on surviving firms' growth.

## 3. Model and data

This study investigates the causal relationships between financial development and firms' growth in the Turkish manufacturing industry over the period 1989–2010. Net sales growth (*sg*) and return on assets (*roa*) are the most widely used indicators in the literature on empirical firm growth (Delmar, 1997). We therefore use these two indicators to represent firms' growth.

As noted by Levine (2004), one has to properly define financial development before examining its impact. The finance–growth literature suggests a good number of financial development indicators. One would maintain that a single indicator may not be able to monitor the certain impact of financial development. Thus, this study utilises seven bank-related and six stock market indicators. Bringing numerous financial development proxies together within the same equation, however, is likely to lead to a multicollinearity problem. Moreover, monitoring the overall impact may yield more consistent findings than using separate proxies (Topcu & Payne, 2017). We therefore implement principal component analysis (PCA) to observe the impacts of banking sector and stock market development on financial development. The method is used to extract a banking sector index (*fdbanking*) as well as a stock market index (*fdstock*) following the literature (Çoban & Topcu, 2013; Topcu & Altay, 2017; among others).

$$sg = f\{findev\} \tag{1}$$

$$roa = f\{findev\} \tag{2}$$

The bank-related variables that are used to construct the *fdbanking* variable are: liquid liabilities to GDP (*llgdp*), central bank assets to GDP (*cbagdp*), deposit money bank assets to GDP (*dbagdp*), private credit by deposit money banks to GDP (*pcrdbofgdp*), bank deposits to GDP (*bdgdp*), financial system deposits to GDP (*fdgdp*) and bank cost–income ratio (*costinc*). Stock market variables that are included to construct the *fdstock* variable are: stock market capitalization to GDP (*stmktcap*), stock market value traded to GDP (*stvaltraded*), stock market turnover ratio (*stturnover*), number of listed companies per 10,000 people (*listco_pc*), private bond market capitalization to GDP (*prbond*) and public bond market capitalization to GDP (*pubond*).

$$fdbank = f\{l\lg dp, cbagdp, dbagdp, pcrdbofgdp, bdgdp, fdgdp, \cos tinc\} \tag{3}$$

$$fdstock = f\{stmktcap, stvaltraded, stturnover, listco\_pc, prbond, pubond\} \tag{4}$$

The data for financial development indicators were gathered from the World Bank Financial Structure Database (2012). The data for *sg* and *roa* were obtained from Borsa Istanbul (BIST, n.d.) Database Industrials records, which include 171 non-financial listed firms from manufacturing industry.

We exclude from the total sample those firms observations for which are not completely recorded for the period 1989–2010. The final dataset includes 93 firms with 2046 observations. Although the dataset consists of firm-level observations, the focus is on the subsector level due to the wider policy implications. The 93 firms are subsumed under seven subsectors: (1) food, beverage and tobacco; (2) textiles, wearing apparel and leather; (3) paper and paper products, printing and publishing; (4) chemicals, petroleum rubber and plastics products; (5) non-metallic mineral products; (6) basic metal industries; and (7) fabricated metal products, machinery and equipment. Table 1 shows the list of firms classified by subsector.

In the light of the existing literature, functional relationships in this study can be formulated as

$$sg = f\{fdbank, fdstock\} \tag{5}$$

$$roa = f\{fdbank, fdstock\} \tag{6}$$

where *sg* and *roa* are firm-level variables, and *fdbank* and *fdstock* are macro-level variables. Equations (5) and (6) are specified in lin-log form as firm-level variables containing negative values. Financial development indicators are converted into natural logarithms after the index values are obtained.

## 4. Methodology and findings

### 4.1. Principal component analysis

PCA, a useful analysis technique for dealing with complex datasets, is helpful for obtaining important output. It is used for the elimination of the dependencies between variables or for the reduction of dimensions. It transforms the data into new, uncorrelated variables.

**Table 1.** Listed firms sorted by subsector.

| | Subsector | | | | | | |
|---|---|---|---|---|---|---|---|
| | S1 | S2 | S3 | S4 | S5 | S6 | S7 |
| | Food, beverage and tobacco | Textile, wearing apparel and leather | Paper and paper products, printing and publishing | Chemicals, petroleum rubber and plastics products | Non-metallic mineral products | Basic metal industries | Fabricated metal products, machinery and equipment |
| Listed firm | | | | | | | |
| | BANVT | ALTIN | DGZTE | AKSA | ADANA | BRSAN | ALCAR |
| | DARDL | BOSSA | DURDO | AYGAZ | AFYON | BURCE | ARCLK |
| | FRIGO | DERIM | HURGZ | BAGFS | ANACM | CELHA | BFREN |
| | KENT | GEDIZ | KARTN | BRISA | ASLAN | CEMTS | BSHEV |
| | MERKO | KORDS | OLMKS | DEVA | BOLUC | COMDO | DITAS |
| | PINSU | KRTEK | tyre | DYOBY | BTCIM | ERBOS | EGEEN |
| | PNSUT | LUKSK | VKING | ECILC | BUCIM | EREGL | FMIZP |
| | TATKS | SKTAS | | EGGUB | CIMSA | FENIS | FROTO |
| | TBORG | SNPAM | | EGPRO | CMENT | IZMDC | MAKTK |
| | TUKAS | YUNSA | | EPLAS | DENCM | SARKY | MUTLU |
| | | | | GOODY | DOGUB | | OTKAR |
| | | | | GUBRF | ECYAP | | PARSN |
| | | | | HEKTS | EGSER | | PRKAB |
| | | | | MRSHL | GOLTS | | TOASO |
| | | | | PETKM | IZOCM | | TUDDF |
| | | | | PIMAS | KONYA | | VESTL |
| | | | | PTOFS | KUTPO | | |
| | | | | TRCAS | MRDIN | | |
| | | | | TUPRS | TRKCM | | |
| | | | | | UNYEC | | |
| | | | | | USAK | | |
| Total | 10 | 10 | 7 | 19 | 21 | 10 | 16 |

Source: Public Disclosure Platform, www.kap.org.tr/en/bist-sirketler.

The current data is compressed by the irrelevant principal components. Each component is simply the weighted average of the variables in hand. The eigenvalue calculates the variation percentage in the total data explained for each principal component (Çoban & Topcu, 2013). For the purpose of eliminating the problem of multicollinearity between financial development variables, we use the PCA technique. By using PCA we obtain two financial development indexes, namely the banking sector development index and the stock market development index, from 1989 to 2010 for Turkey. Table 2 reports the factor weightings for each variable.

### 4.2. Panel unit root

The unit root procedure is the essential step for any kind of empirical investigation to check whether the series contain a unit root. This study uses the widely used unit root techniques developed by Levin, Lin, and Chu (LLC, 2002) and Im, Pesaran, and Shin (IPS, 2003)

$$\Delta yit = \alpha i + \eta iyit - 1 + \delta it + \sum_{k=1}^{Ki} \theta_i^{(k)} \Delta yit - k + \varepsilon it \tag{7}$$

where

$$\varepsilon it \overset{iid}{\approx} N(0, \sigma_\varepsilon^2);\ i = 1, ..., N;\ t = 1, ..., T \tag{8}$$

**Table 2.** Weightings obtained from PCA for banking and stock markets for Turkey.

| Banking sector variable | Weighting | Stock market variable | Weighting |
|---|---|---|---|
| Liquid liabilities/GDP | 0.155561 | Stock market capitalization/GDP | 0.195068 |
| Central bank assets/GDP | 0.160639 | Stock market total value traded/GDP | 0.193057 |
| Deposit money bank assets/GDP | 0.158025 | Stock market turnover ratio | 0.166819 |
| Private credit by deposit money banks/GDP | 0.121115 | Number of listed companies per 10,000 population | 0.162816 |
| Bank deposits/GDP | 0.158250 | Private bond market capitalisation/GDP | 0.116947 |
| Financial system deposits/GDP | 0.158025 | Public bond market capitalisation/GDP | 0.165294 |
| Bank cost–income ratio | 0.088384 | | |

Notes: PCA outputs are not reported. These are available upon request.
Source: Author estimation results.

The test results shown in Table 3 indicate that the null hypothesis of a unit root is rejected for all variables, and hence the variables found under investigation are integrated for $I(0)$.

### 4.3. Cross-sectional dependence

Sarafidis and Wansbeek (2012) argue that one important concern in the literature is whether the cross-sections of the panel dataset are dependent or not. The results are likely to be inconsistent and biased if the cross-sections are dependent. In addition, as noted by Bai and Kao (2006), the cross-sectional dependence problem could also exist even in studies with disaggregate data because of herd behaviour either at firm or household levels.

Various cross-sectional dependence tests have been employed in the empirical econometrics literature. Among these tests (see, for example: Breusch & Pagan, 1980; Ng, 2006; Pesaran, 2006), that commonly used is the cross-sectional dependence (CD) test developed by Pesaran (2004). The formulation of Pesaran's CD test is

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho ij}\right) \tag{9}$$

**Table 3.** LLC and IPS unit root results.

| | Test | LLC | | | | IPS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Variable | *nsg* | *roa* | Bank | Stock | *nsg* | *roa* | Bank | Stock |
| Unit | Model | Stat | Stat | Stat | Stat | Stat | Stat | Stat | Stat |
| 1 | *c* | −4.566*** | −4.919*** | 6.213 | −8.435*** | −3.266*** | −4.142*** | 5.741 | −4.223*** |
| | *c* + *t* | −8.192*** | −4.144*** | −9.094*** | −3.337*** | −7.988*** | −5.181*** | −6.313*** | 2.010 |
| 2 | *c* | −5.780*** | −6.075*** | 6.213 | −8.435*** | −3.964*** | −5.909*** | 5.741 | −4.223*** |
| | *c* + *t* | −6.470*** | −3.796*** | −9.094*** | −3.337*** | −7.314*** | −4.626*** | −6.313*** | 2.010 |
| 3 | *c* | −2.050** | −3.086*** | 6.213 | −8.435*** | −1.019 | −3.665*** | 5.741 | −4.223*** |
| | *c*+*t* | −5.639*** | −3.101*** | −9.094*** | −3.337*** | −5.429*** | −3.358*** | −6.313*** | 2.010 |
| 4 | *c* | −5.163*** | −6.590*** | 6.213 | −8.435*** | −3.424*** | −6.794*** | 5.741 | −4.223*** |
| | *c* + *t* | −11.341*** | −6.618*** | −9.094*** | −3.337*** | −10.268*** | −6.513*** | −6.313*** | 2.010 |
| 5 | *c* | −3.770*** | −6.406*** | 6.213 | −8.435*** | −1.110 | −5.742*** | 5.741 | −4.223*** |
| | *c* + *t* | −11.229*** | −6.135*** | −9.094*** | −3.337*** | −8.441*** | −6.732*** | −6.313*** | 2.010 |
| 6 | *c* | −5.733*** | −2.463*** | 6.213 | −8.435*** | −3.494*** | −3.576*** | 5.741 | −4.223*** |
| | *c*+*t* | −9.155*** | −1.571* | −9.094*** | −3.337*** | −8.904*** | −3.225*** | −6.313*** | 2.010 |
| 7 | *c* | −3.088*** | −5.036*** | 6.213*** | −8.435*** | −2.249** | −4.883*** | 5.741 | −4.223*** |
| | *c* + *t* | −10.561*** | −5.758*** | −9.094*** | −3.337*** | −9.544*** | −5.200*** | −6.313*** | 2.010 |

Notes: *c* signifies models with intercepts while *c* + *t* signifies models including both intercept and trend.
***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.
Source: Author estimation results.

The test results reported in Table 4 show that the null hypothesis indicating the absence of cross-sectional dependence is rejected for either all units or functions. These results confirm the presence of cross-sectional dependence.

### 4.4. Panel causality

The conventional causality tests are not robust to heterogeneity and cross-sectional dependence. This study therefore employs a heterogeneous panel proposed by Dumitrescu and Hurlin (2012) The test statistic for this test is

$$yit = \alpha i + \sum_{k=1}^{K} \gamma_i^{(k)} yi, t-k + \sum_{k=1}^{K} \beta_i^{(k)} xi, t-k + \varepsilon i, t \tag{10}$$

Table 5 presents the Dumitrescu and Hurlin (2012) causality results. We only report the results for seven subsectors in Table 5.[1] Although the findings provide some cross-section-specific results, however, the results in general indicate causality from financial development to firm growth. The results for the causality relationships for each subsector are given in Table 6. As the table indicates, the direction of causal ordering may be slightly responsive to the different measures for financial development and/or firm growth despite the dominant support in favour of the supply-leading hypothesis.

## 5. Discussion

In this section, we discuss our empirical results in the context of what they mean for the subsector as well as how consistent they are with the prior literature. The findings of this

**Table 4.** Pesaran's CD test results.

| Unit | *nsg* = *f*(*bank*) | *nsg* = *f*(*stock*) | *roa* = *f*(*bank*) | *roa* = *f*(*stock*) |
|---|---|---|---|---|
| 1 | 14.937*** | 15.477*** | 5.168*** | 5.509*** |
| 2 | 18.880*** | 18.051*** | 6.731*** | 5.845*** |
| 3 | 9.644*** | 9.899*** | 3.304*** | 3.745*** |
| 4 | 20.325*** | 18.071*** | 10.174*** | 9.870*** |
| 5 | 30.098 | 31.368*** | 11.183*** | 10.490*** |
| 6 | 16.528*** | 16.417*** | 3.874*** | 3.018*** |
| 7 | 16.575*** | 19.502*** | 1.681* | 2.309** |

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.
Source: Author estimation results.

**Table 5.** Panel causality results.

| Null hypothesis Unit | $H_0$: *nsg* does not cause bank | $H_0$: bank does not cause *nsg* | $H_0$: *nsg* does not cause stock | $H_0$: stock does not cause *nsg* | $H_0$: *roa* does not cause bank | $H_0$: bank does not cause *roa* | $H_0$: *roa* does not cause stock | $H_0$: stock does not cause *roa* |
|---|---|---|---|---|---|---|---|---|
| 1 | 2.740*** | 5.036*** | 0.816 | 4.324*** | 3.089*** | 1.822 | 0.721 | 2.364** |
| 2 | 1.984 | 7.834*** | 0.536 | 4.585*** | 1.082 | 2.411** | 1.273 | 2.681*** |
| 3 | 3.462*** | 5.928*** | 0.695 | 6.109*** | 0.560 | 1.205 | 1.758 | 1.518 |
| 4 | 4.351*** | 5.374*** | 1.088 | 5.466*** | 0.957 | 1.949** | 0.735 | 1.916* |
| 5 | 4.245*** | 5.678*** | 0.777 | 5.628*** | 0.820 | 2.060** | 1.742 | 1.814* |
| 6 | 6.036*** | 5.774*** | 1.281 | 4.828*** | 1.645 | 2.249** | 2.875*** | 2.046* |
| 7 | 3.157*** | 2.900*** | 0.797 | 5.093*** | 0.643 | 2.385*** | 1.529 | 3.340*** |

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.
Source: Author estimation results.

**Table 6.** Subsector-specific relationships.

| Subsector | Relationship | | | |
|---|---|---|---|---|
| 1 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | Bank ⇐ *roa* | Stock ⇒ *roa* |
| 2 | Bank ⇒ *nsg* | Stock ⇒ *nsg* | Bank ⇒ *roa* | Stock ⇒ *roa* |
| 3 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | ∅ | ∅ |
| 4 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | Bank ⇒ *roa* | Stock ⇒ *roa* |
| 5 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | Bank ⇒ *roa* | Stock ⇒ *roa* |
| 6 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | Bank ⇒ *roa* | Stock ⇔ *roa* |
| 7 | Bank ⇔ *nsg* | Stock ⇒ *nsg* | Bank ⇒ *roa* | Stock ⇒ *roa* |

Source: Author estimation results.

study reveal that either *fdbank* or *fdstock* causes *sg* in the whole subsample. This clearly indicates that available funds for firms to finance their activities or borrowing on easy terms will affect net sales of firms, which, in turn, will affect the banking sector due to high transaction volumes. The causal interaction between financial development and *roa* is not as uniform as we found using *sg*. Industries with high profitability produce high value-added products so that at least one-way causality from financial development to *roa* seems appropriate. Similarly, a significant impact of financial development on *roa* can also be explained in the same way as in the case for *sg*.

In addition to the abovementioned results, there are also several interesting aspects of Table 5 that involve incompatibilities across subsectors for a given relationship. The results show the following. (i) Banking sector development does not cause net sales growth in the wearing apparel and leather industry, unlike the other subsectors. The reason of this shortage in this industry is probably due to the relative small transaction volumes in the banking sector. (ii) The direction of causality in the food, beverage and tobacco industry is not from banking sector development to return on assets, but the other way around. That is, the expansion of this industry increases the demand for financial services. One possible reason for this diversity may be the debt/equity ratio. The food, beverage and tobacco industries have the highest average debt/equity ratio over the periods examined when compared with the other six. Moreover, along with the textile, wearing apparel and leather industry, the food, beverage and tobacco is the least capital-intensive industry, and the number of firms in these subsectors is higher than those of the rest. We also note that these two subsectors generally contain exporting firms so that their need for financing sources is limited as export sales are usually in advance or with credit terms that are too short. (iii) No causality is detected between return on assets and financial development in the case of the paper, paper products, printing and publishing industry. Firms in this industry import raw materials and production technologies. Providing loans for import credits are more difficult than for exports credits through national banks and, thus, the validity of the irrelevance hypothesis may be comprehensible given the low importance of the domestic financial sector. Hence, we could infer that financial development proves a minor contribution to firm growth in this industry, as expressed by Lucas (1988), or the impact of financial activities on firm growth can be ignored as suggested by Stern (1989). (iv) The stock market development–return on assets nexus in the basic metal industry supports the demand-following hypothesis as well as the supply-leading hypothesis, which is uniform across all subsectors. As the industry includes large firms, these firms' shares give confidence to shareholders, and expansion of the industry may affect the stock market via increased consumer confidence.

To sum up, apart from a few specific findings, causality usually runs from financial development to firm growth, which provides strong support for the supply-leading hypothesis

in the Turkish manufacturing industry. Overall, this study provides evidence that the causality between financial development and firm growth, which is measured using net sales growth, provides consistent results across subsectors, whereas results using return on assets are not uniform. Different measures of financial development do not widely matter, while the measurement of firm growth does really matter in Turkish manufacturing industry.

The empirical findings in the literature are not directly comparable to our results. Assessing the validity of the finance-led growth hypothesis using micro-level data is difficult in the new era of finance-growth literature. While the literature has focused on this issue at either country, level with respect to different stages of financial development, or firm level, we focus on the industry level. Our results are in line with the results of Rajan and Zingales (1998) and Fisman and Love (2002) in which financial development is found to affect industrial growth. The evidence in this study is also consistent with Guiso et al. (2004) and Gagliardi (2009) who find a positive impact of financial development on firm growth in Italy, as well as with Morón et al. (2013), who obtain the same findings in Peruvian manufacturing industry. Once the literature was evaluated with regard to the financial development proxy, banking sector results are in line with Beck et al. (2003). Stock market results, on the other hand, are also consistent with Gallego and Loayza (2000), who find a positive impact of stock market development on firm growth in Chile. In addition, Demirgüç-Kunt and Maksimovic (1998), whose results indicate that both the stock market and banking sector development affect firm growth positively, also report findings similar to those of this study.

## 6. Conclusions

This study investigates the causal relationships between financial development and firm growth for seven subsectors in Turkish manufacturing industry for the period 1989–2010 within a panel-based non-causality test, which considers heterogeneity and cross-sectional dependence. We construct two financial development indexes representing the banking sector and stock market development using PCA, and proxy firm growth using net sales growth and return on assets. Our findings strongly support the supply-leading hypothesis once firm growth is measured using net sales growth. When the source of financial development is separated, in addition, findings support the demand-following hypothesis for the banking sector. The empirical results indicate the validity of the supply-leading hypothesis in four subsectors and the demand-following hypothesis in two subsectors once the relationship is considered within the context of banking sector development–return on assets. In the case of the stock market development–return on assets nexus, the supply-leading hypothesis is valid for six out of seven subsectors, while one subsector also supports the demand-following hypothesis. Moreover, we explore the validity of the irrelevance hypothesis in one subsector alone. Overall, findings reveal a strong indication in favour of the supply-leading hypothesis, and it is found that return on assets, as an indicator of firm growth, seems more likely to produce industry-specific results, whereas net sales growth provides consistent results across the subsectors.

This study opens a new venue for researchers to test whether developments in financial infrastructure are a matter for firms to come out ahead and grow as a result, or vice versa. Even though it seems a little constrictive to carry out studies including multi-country analyses, given the difficulty in gathering micro-level data, we believe that future researchers can shed light on the domestic relationship between financial development and firm growth.

## Note

1. Dumitrescu and Hurlin's (2012) method computes causality results for each firm as well as the subsectors. These results, however, are not reported herein for two reasons. First, firm-based results are mostly consistent with the results for relevant subsectors, as expected. Thus, it can be inferred that subsector results reflect firms' characteristics results in general. Second, it would be quite difficult to report the results for 93 firms under eight relationships. If requested, however, they can be provided by the authors.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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