ADBI Working Paper Series

Financial Health and Firm Productivity: Firm-level Evidence from Viet Nam

Shandre M. Thangavelu and
Aekapol Chongvilaivan

No. 434
September 2013

Asian Development Bank Institute

Shandre M. Thangavelu is Associate Professor, Department of Economics, NUS.
Aekapol Chongvilaivan is Fellow, Institute of Southeast Asian Studies, Singapore.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. ADBI encourages readers to post their comments on the main page for each working paper (given in the citation below). Some working papers may develop into other forms of publication.

Suggested citation:

Thangavelu, S.M., and A. Chongvilaivan. 2013. Financial Health and Firm Productivity: Firm-level Evidence from Viet Nam. ADBI Working Paper 434. Tokyo: Asian Development Bank Institute. Available: http://www.adbi.org/working-paper/2013/09/20/5899.financial.health.firm.prod.viet.nam/

Please contact the authors for information about this paper.

Email: ecssmt@nus.edu.sg; aekapol@iseas.edu.sg

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

Abstract

Does financial health shore up firm productivity? This paper empirically investigates this question and presents productivity as another driving factor in translating financial development into real economic progress. Our empirical framework employs Levinsohn and Petrin's (2003) semi-parametric estimation of total factor productivity (TFP) using firm-level panel data during 2002–2008, and incorporates financial health variables into conventional determinants of firm productivity. Our findings suggest that liquidity and access to external credit boosts firm productivity, with the latter particularly imperative for exporting and/or importing firms. We also present supplementary results regarding economies of scale, high-tech capital accumulation, human capital investment and foreign ownership.

JEL Classifications: O16; O25; O53

Contents

1. INTRODUCTION

The growing body of research focused on examining the linkage between financial development and its real consequences almost unanimously points to various economic gains from improvement of finances. This strand of literature often deals with whether, and how, finances foster firm survival and growth. For instance, Levine (2005), Beck et al. (2005) and Demirguc-Kunt and Maksimovic (1998) have demonstrated that financial constraints, such as low liquidity and limited access to external funds, exacerbate the growth prospects of a firm. A recent study by Ayyagari et al. (2010) posits that efficient financial resource allocation is a key driver of the mechanism through which financial health bolsters growth and survival. Likewise, Alfaro et al. (2006; 2004) show evidence that a well-developed financial market is a prerequisite for the positive effects of foreign investment on economic growth.

This paper looks at another positive aspect of sound financial attributes, namely firm productivity – a potentially impacted variable of financial development that has been largely unexplored in the literature to date. Financial health, arguably, allows a firm to seize new business opportunities, carry out exceptional investment and research and development (R&D) activities, build a shield against financial and non-financial shocks and, ultimately, realize superior productivity. More importantly, firm productivity is a fundamental catalyst at the micro level for translating financial market development into economic growth and development at the macro level. Therefore, it may be interesting to investigate the extent to which financial health advances firm productivity, an inquiry that could shed light on the link between finances and real economic gains.

The objective of this paper is to empirically investigate the effects of financial health on firm productivity using the micro-level panel data of firms in Viet Nam from 2002–2008. Our empirical strategy comprises two steps. Firstly, we employed the semi-parametric estimation of total factor productivity (TFP) introduced by Levinsohn and Petrin (2003) to control for the potential correlation between unobservable productivity shocks and input choices. Secondly, we developed the empirical framework in which two indices of financial health, in particular liquidity and access to external credit are incorporated into the model with other determinants of firm productivity. Thus, we meticulously account for several potential econometric problems such as heteroskedasticity, unobservable firm-specific characteristics and endogeneity biases of the control variables.

We present fairly robust evidence that financial health holds the key to achieving exceptional productivity. Firms with high liquidity and ability to leverage on external finances appear to exhibit higher levels of TFP, suggesting that financial market development is the pivotal impetus for embracing accelerated industrialization and firm development. A breakdown of surveyed firms by exposure to international markets paints a clearer picture that access to external credit is particularly critical for exporting and importing firms, as international trade activities necessitate additional external credit. Our parameter estimates also point to productivity enhancement emanating from economies of scale, high-tech capital accumulation, human capital investment and, not least, foreign ownership.

The rest of this paper can be outlined as follows: Section 2 provides a primer of financial development and productivity growth in Viet Nam; Section 3 details data construction and measurement; Section 4 estimates the Levinsohn-Petrin TFP and develops the empirical framework and strategies; Section 5 presents the parameter estimates and discusses the main findings; and Section 6 concludes with some policy implications.

2. FINANCIAL DEVELOPMENT AND PRODUCTIVITY GROWTH IN VIET NAM

Since the advent of policy reforms (*doi moi*) in 1986, Viet Nam's economy has consistently achieved a high rate of economic growth in addition to improved standards of living and rapid poverty reduction. During the period 2000–2010, the economy enjoyed an impressive gross domestic product (GDP) growth rate of 7.22% – the second highest among ASEAN+3 countries following the People's Republic of China (PRC).[1] The accelerated pace of economic growth has been fueled largely by growth in the manufacturing and construction sectors, accounting for approximately 40% of growth and realizing a value added growth of 10.6%, on average, during the same period. As shown in Table 1, firm performance is equally remarkable in terms of both output growth and contributions to employment. During the period 2000–2010, output and employment growth among firms in Viet Nam reached an average rate of 7.5 and 2.3%, respectively. A breakdown of Vietnamese firms by ownership type further indicates that firm performance is strikingly high among foreign-owned enterprises.

Table 1: Output and Employment Growth by Ownership, 2000–2008

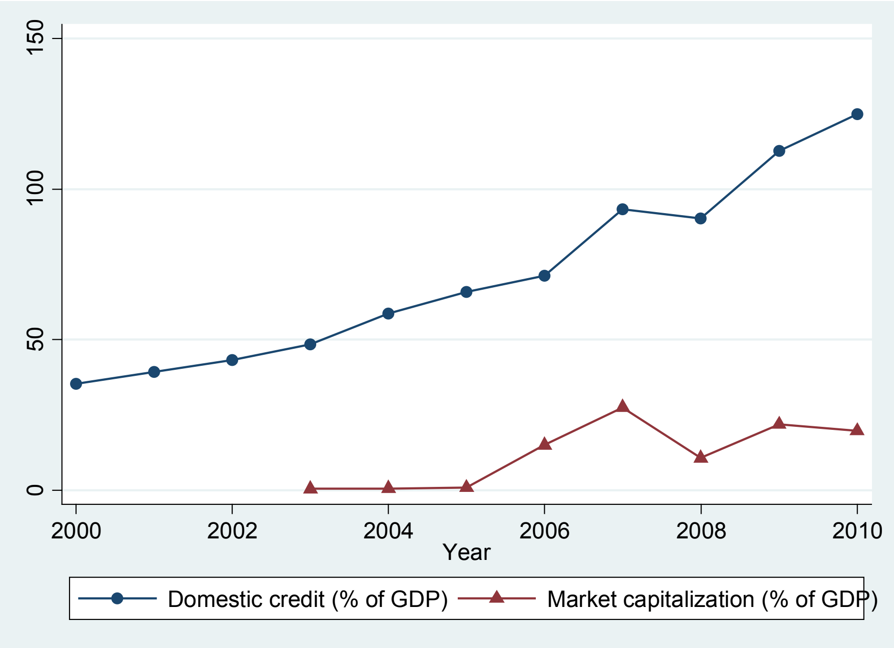
	Output Growth (% p.a.)	Employment Growth (% p.a.)
Total	7.5	2.3
State	6.8	1.85
Non-state	7.3	1.93
Foreign Firms	10.4	20.41

Source: General Statistics Office, Viet Nam; p.a., per annum.

Among the drivers of Viet Nam's economic miracle is financial market development (World Bank 2006). In the banking sector, domestic credit to the private sector escalated from 39.3% of GDP in 2000 to 125% in 2010 (Figure 1). Likewise, in the securities market, market capitalization of listed companies reached approximately 20% of GDP by 2010 in contrast to merely 0.4% in 2003. However, access to external credit has been generally uneven between private firms and state-owned enterprises (SOEs). According to the World Bank (2006), about 38% of total credit in the economy goes to SOEs, which account for only 3.8% of total employment. As financial resources have become allocated more efficiently, liquidity and availability of funds and credit have allowed banks and other financial institutions to meet growing demands for short- and long-term finances, allowing firms in turn to leverage on ample business opportunities, superior investment decisions, exceptional business capacity and, ultimately, ability to flourish in the markets. Given the turnaround of financial market development that has allowed the country to take off as an increasingly competitive economy, firms in Viet Nam provide an exceptional model of the linkage between financial health and firm productivity.

[1] The figure for the average GDP growth rate is calculated from *World Development Indicators*, the World Bank.

Figure 1: Financial Market Development in Viet Nam



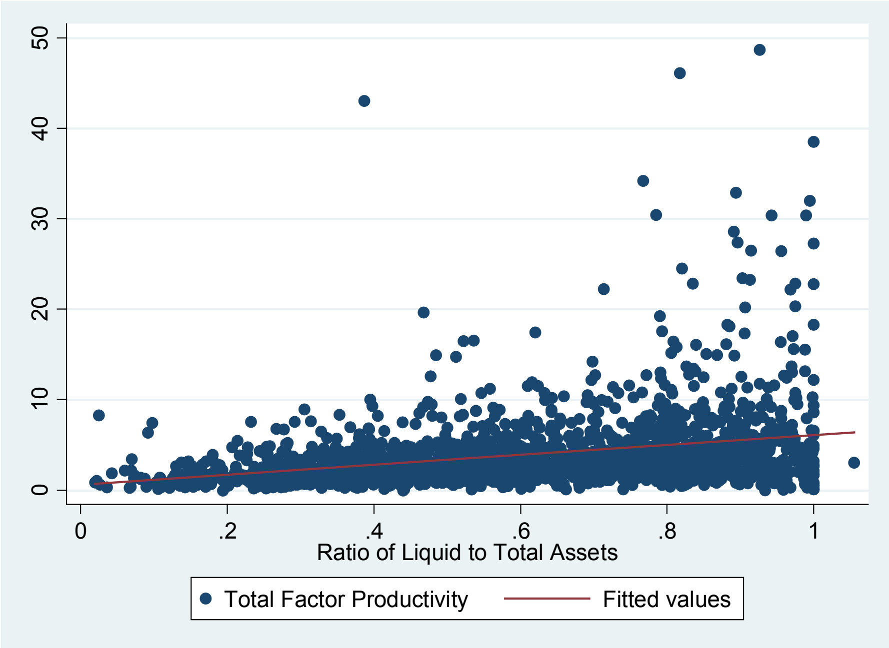
GDP = gross domestic product.

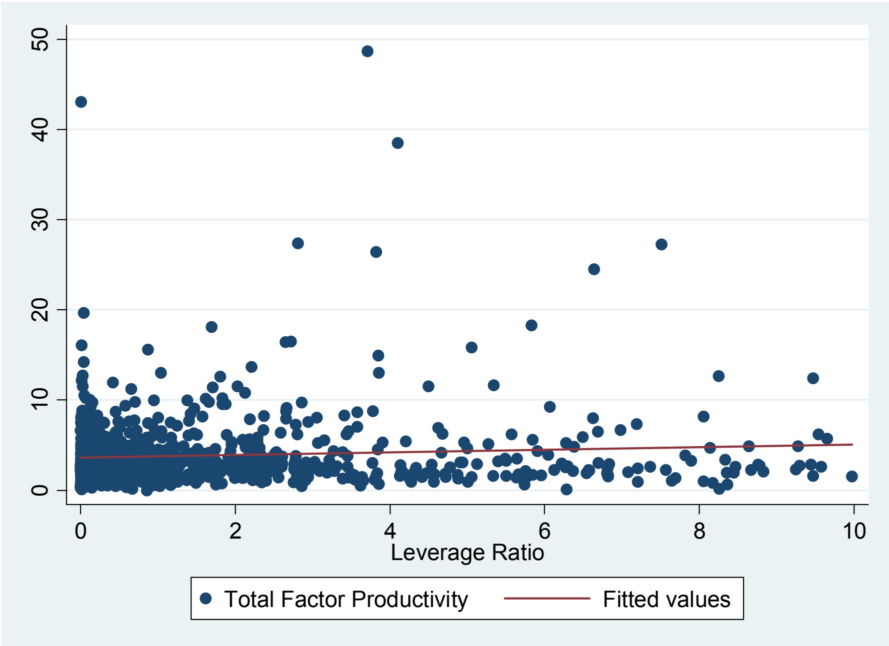
Source: World Development Indicators (WDI), World Bank.

Figure 2 provides a preliminary illustration of the extent to which financial attributes shape firm productivity and performance. Simple scattered plots were generated by pooling relevant variables across a time horizon. The left panel is a scattered plot between TFP and the liquidity measure, while the right panel relates TFP to the leverage ratio – the measure of access to external credit.[2] Both panels exhibit the positive, albeit modest, correlation between financial health and TFP. Consistent with Anwar and Nguyen (2012), firms with a higher degree of liquidity and access to external credit tend to have higher TFP. This suggests that financial health is a potential driving force for firm productivity in Viet Nam. Although it is possible that this positive correlation is sensitive to the exclusion of outliers, the following discussions are devoted to a formal analysis of the relationship between financial health and TFP.

[2] Detailed discussion of data measurements is provided in Section 3.

Figure 2: A Fitted Plot of Total Factor Productivity versus Financial Health Indicators





Source: Authors' calculation.

3. DATA SOURCES AND MEASUREMENTS

The firm-level data for this study was retrieved from *Annual Statistical Censuses & Surveys: Enterprises* from 2002–2008, gathered by the General Statistics office of Viet Nam. It provides firm-level information on production and financial characteristics such as number or workers, gross revenue, working capital, materials, profits, liquid assets, fixed assets as well as liabilities and equity, among many others. The firms in our dataset operate across a wide range of economic sectors. Most of them deal with manufacturing and service activities like trade, hotels and restaurants, as well as real estate business and consultancy. Our firm-level panel comprised a total of 5,302 annual observations, spanning the years 2002–2008.

As discussed in the following section, a set of variables is utilized for our empirical framework. Firstly, the measurement of TFP rests on the estimation of a Cobb-Douglas production function, which requires information on a firm's gross output as well as production inputs. Net output is measured by sales of goods produced net of materials and component purchases. There are three production inputs in the empirical model: labor, intermediate materials and capital. Labor is the number of workers employed by a firm. Intermediate materials include parts and components that are used in the production processes. Capital is the value of land, building and construction as well as machinery and equipment, less the depreciation of assets. We examined two financial attributes of a firm: liquidity, measured by the ratio of liquid (short-term) assets to total assets; and leverage ratio, the ratio of liabilities to equity. Besides the financial health variables, we attempted to control for four firm-specific characteristics including firm size, high-tech capital accumulation, human capital investment and foreign ownership. Firm size is proxied by the total sales of a firm. High-tech capital accumulation is measured by the number of computers used per worker. The ratio of skilled to total workers employed by a firm serves as the measure of human capital investment. Lastly, the proportion of investment capital undertaken by foreign parties relative to the total registered capital is used as a proxy of foreign ownership.

4. EMPIRICAL FRAMEWORK

4.1 Levinsohn-Petrin TFP Estimation

Total factor productivity (TFP) is a natural measure of firm productivity. It essentially captures the growth in output that cannot be explained by changes in production inputs, and thus serves as a traditional proxy of productivity improvement within a firm. A key criticism of TFP estimation, however, is a potential correlation between unobservable firm-specific productivity shocks and the optimal choices of input levels. This implies that the standard ordinary least squared (OLS) estimation of a production function, which implicitly assumes away such a potential correlation, tends to produce biased and inconsistent estimates (Griliches and Mareisse 1998). There are at least two approaches to estimating TFP, which accounts for the sensitivity of optimal input levels to productivity shocks: the Olley-Pakes TFP measurement uses investment as a proxy for productivity shocks (Olley and Pakes 1996), and the Levinsohn-Petrin TFP measurement builds upon production theory and uses intermediate inputs, rather than investment, as a proxy (Levinsohn and Petrin 2003).

In this paper, we have opted for the semi-parametric framework of the Levinsohn-Petrin TFP estimation to control for the unobserved productivity shocks, for three main reasons. Firstly, our dataset does not provide valid information on firm investment, and thus the Olley-Pakes TFP estimation, which necessitates the investment variable, is not feasible. Secondly, and more importantly, even if the investment data were available, the estimates would be prone to suffer from the truncating of all firms reporting 'zero' investment. Lastly, the Levinsohn-Petrin TFP is more satisfactory to us than the Olley-Pakes estimation from a theoretical point of view because it is constructed from production theory, while we consider the latter specification to be rather *ad hoc*. We assume that a firm's production technology takes the log-linearized Cobb-Douglas functional form:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it}, \quad (1)$$

where y_{it} is the logarithm of a firm *i*'s net output in year *t*; l_{it} and m_{it} denote the log-levels of the freely variable inputs, labor and materials, respectively; and k_{it} is the logarithm of quasi-fixed capital. It should be noted that Levinsohn and Petrin assume productivity shocks to comprise two additively separable components: the transmitted and independent, identically distributed (iid) components denoted by ω_{it} and η_{it}, respectively.[3] The former accounts for the potential correlation between the productivity shocks and input choices, and is the source of simultaneity biases associated with the OLS estimation, while the latter captures the exogenous shocks that are uncorrelated with input choices.

Table 2 shows the Levinsohn-Petrin estimates of the log-linearized Cobb-Douglas production technology. The Wald's test of returns to scale is statistically significant at the 10% level, and therefore indicates increasing returns for the estimated production technology. We then used the estimates of the production function to generate the Levinsohn-Petrin TFP.

Table 2: Levinsohn-Petrin Estimation of Production Technology

Dependent Variable: y_t	
l_t	$.3357^{***}$ (.0435)
m_t	.1065 (.2121)
k_t	$.6716^{***}$ (.1714)
No. Obs.	1825
Wald's Test of Returns to Scale	3.31^{*}

No. Obs. = number of observations.

Note: (1) ***, *: statistically significant at the 1% and 10% levels, respectively; and 2) the Wald's test is Chi-square distributed against the null hypothesis that production technology is constant for returns to scale.

4.2 Empirical Framework and Estimation

In this section, we attempt to model the linkage between the financial health and productivity performance of a firm. Our empirical strategy builds upon the standard model of firm productivity, in which TFP is regressed against the financial health variables in addition to firm-specific characteristics. The simplest econometric specification perhaps takes the following expression:

[3] Levinsohn and Petrin (2003) also assume that unobservable productivity shocks follow a first-order Markov process. The estimation can be done in two steps. The first step entails a third-order polynomial approximation to estimate the conditional moments, $E(y_{it}|k_{it}, m_{it})$ and $E(l_{it}|k_{it}, m_{it})$. The second step involves solving the Generalized Method of Moments (GMM) to identify parameter estimates.

$$TFP_{it}^{L-P} = \alpha_0 + \alpha_1 \ln LIQUIDITY_{it} + \alpha_2 \ln LEVERAGE_{it} + \alpha_3 \ln SIZE_{it} + \alpha_4 \ln COM_{it}$$

$$+ \alpha_5 \ln HUMANK_{it} + \alpha_6 \ln FOWN_{it} + u_{it}, \quad (2)$$

where the subscripts *i* and *t* denote firms and time, respectively. TFP_{it}^{L-P} is the Levinsohn-Petrin TFP derived from the semi-parametric estimation of the production technology depicted in Section 4.1. u_{it} is the stochastic error term.

Central to our empirical framework are the variables of financial health. Our econometric specification incorporates two conventional proxies of a firm's financial quality – liquidity ($LIQUIDITY_{it}$) and leverage ratio ($LEVERAGE_{it}$). Our key hypothesis is that a firm with better financial health tends to exhibit a superior productivity level. Specifically, a firm with high liquidity is supposed to be resilient to financial and non-financial shocks, experience high growth, and therefore demonstrate exceptional performance (Beck et al. 2005). Likewise, access to large external finance helps a firm ease the degree of credit constraints, thereby increasing its capacity and survival in the market (Aghion et al. 2007; Levine 2005). Although a wealth of past studies have examined how a firm's financial quality is associated with various aspects of firm performance such as growth, pliability to financial shocks and survival, little has been done, at least empirically, to investigate the nexus between financial health and TFP, especially in the context of transitional economies like Viet Nam.

Apart from the financial health variables, we also controlled for several firm-specific characteristics from the literature that examine firm productivity performance. Firstly, firm size ($SIZE_{it}$) aims to control for the effects of economies of scale on firm productivity as examined by, for instance, Balk (2001).[4] In this regard, the Levinsohn-Petrin estimates of production technology given in Table 4 point to the existence of increasing returns to scale. As discussed by Oliner and Sichel (1994; 2000), high-tech capital intensity (COM_{it}) serves as another determinant of TFP. High-tech capital accumulation has proven to be a crucial driving factor for augmented productivity by enhancing operating performance, profitability and, ultimately, productivity growth (Morrison and Berndt 1991; Siegel and Griliches 1992). Equally important, however, is human capital intensity. Since the 1990s, developing Asian economies, including Viet Nam, have embraced investment in human capital, e.g. education and training, as a pivotal growth strategy. It may be of interest to estimate the extent to which human capital intensity ($HUMANK_{it}$) accounts for TFP. The last, but not least, determinant of firm productivity, which has been intensively discussed by Arnold and Javorcik (2009), Benfratello and Sembenelli (2006), Germa et al. (2004) and Griffith (1999), among others, is foreign ownership ($FOWN_{it}$).[5] These studies propose that foreign-owned firms are likely to have superior managerial expertise, information networks and

---

[4] As described in Section 3, firm size is measured by total sales of a firm. An alternative measurement of firm size is the number of workers. However, this parameter may not be appropriate due to its potential multicollinearity with COM_{it}.

[5] In contrast to previous studies that typically employed dummies of foreign ownership, the foreign ownership variable in this paper pertains to the proportion of foreign-owned registered capital relative to total registered capital. This allows us to capture the effects of different degrees of foreign ownership on level of productivity.

exposure to international markets, and thus are expected to outperform domestic firms.[6]

In the present study, we address three main econometric issues: heteroskedasticity, unobservable firm heterogeneity and potential endogeneity biases. These considerations are likely to be highly pertinent in firm-level studies like ours, while the standard ordinary least squares (OLS) estimation method is liable to yield biased estimates if these issues remain ignored. Since the firms in our dataset vary in size, the stochastic error term (u_{it}) may be heteroskedastic, thereby biasing the standard OLS estimates. We have employed the heteroskedasticity-robust procedure to obtain consistent estimates in all cases, unless otherwise stated. Additionally, we cannot rule out the existence of unobservable firm heterogeneity, given that firms operate a wide array of economic activities such as manufacturing, financial intermediation, trade, real estate and consultancy services. We address this issue by resorting to Fixed Effects (FE) and Random Effects (RE) estimations. The former is obtained by OLS estimation, whereas the latter is derived from the generalized least squares (GLS) estimation using the Swamy-Arora estimators. In this regard, the Breusch-Pagan test is undertaken under the null hypothesis that there are no random effects. The econometric specification (2), therefore, can be re-written as:

$$TFP_{it}^{L-P} = \alpha_0 + \alpha_1 \ln LIQUIDITY_{it} + \alpha_2 \ln LEVERAGE_{it} + \alpha_3 \ln SIZE_{it} + \alpha_4 \ln COM_{it}$$

$$+ \alpha_5 \ln HUMANK_{it} + \alpha_6 \ln FOWN_{it} + \mu_i + u_{it}, \quad (3)$$

where μ_i denotes the unobservable firm-specific effects.

Lastly, we are also concerned that the FE and RE estimates may also be biased and inconsistent because our control variables, in particular financial health, firm size, high-tech capital intensity and human capital investment are, arguably, endogenously determined by other unobserved variables. If this were the case, the estimates, as is well known, would not consistent and asymptotically efficient. There are at least two standard panaceas for addressing potential endogeneity biases. One is the instrumental variable estimation whereby instrumental variables (IVs) – those that are exogenous and strongly correlated with endogenous explanatory variables – are used to obtain consistent estimates. However, the lack of valid IVs in our dataset precludes this approach. The other remedy is to carry out the two-step Blundell-Bond estimation (Blundell and Bond 1998; Arellano and Bover 1995) in which logs of structural variables are chosen as IVs to correct for any simultaneity biases with the generalized method of moments (GMM) estimation. In doing so, the econometric specification (2) has to be modified as follows:

$$TFP_{it}^{L-P} = \alpha_0 + \alpha_1 TFP_{it-1}^{L-P} + \alpha_2 \ln LIQUIDITY_{it} + \alpha_3 \ln LEVERAGE_{it} + \alpha_4 \ln SIZE_{it}$$

$$+ \alpha_5 \ln COM_{it} + \alpha_6 \ln HUMANK_{it} + \alpha_7 \ln FOWN_{it} + u_{it}, \quad (4)$$

where α_1 captures the partial dynamic adjustments of TFP_{it}^{L-P}. Accordingly, we use Sargan statistics to test the hypothesis that the over-identifying restriction is valid.

The descriptive statistics and correlation matrix of the structural variables are provided in Tables 3 and 4, respectively. Although the correlation matrix in Table 4 implies that

[6] As demonstrated later in the next section, we also account for the possibility that the degree of foreign ownership is associated with financial health. In doing so, we perturb the base-line specification by introducing the interaction between financial health variables and foreign ownership into the specification (2).

the correlation among the explanatory variables is negligible, it may be necessary to account for the indirect effects of the control variables on TFP. For instance, a firm with a high degree of foreign ownership may have higher liquidity and access to external credit, and be able to exhibit higher productivity. In this case, our main findings may be sensitive to model specifications. To test the robustness of our results, we perturbed our econometric specifications (2)-(4) by encompassing the interaction between financial health variables and foreign ownership.[7]

Table 3: Summary of Statistics

Variable	Obs.	Mean	S.D.	Min	Max
$\ln FDI$	5158	-.2833	.4515	-4.382	1.099
$\ln LIQUIDITY$	5138	-.5264	.7160	-6.598	.0533
$\ln LEVERAGE$	1845	-.6158	2.411	-10.55	6.743
$\ln SIZE$	4905	9.136	2.475	.6932	17.99
$\ln COM$	4642	-2.028	1.126	-5.622	2.481
$\ln HUMANK$	5078	-1.121	.7046	-4.727	0

Table 4: Correlation Matrix of Structural Variables

	FDI	*LIQUIDITY*	*LEVERAGE*	*SIZE*	*COM*	*HUMANK*
FDI	1.000					
LIQUIDITY	-.0117	1.000				
LEVERAGE	-.0185	.0816	1.000			
SIZE	-.0318	.0965	.2064	1.000		
COM	.0586	.1319	-.0634	-.2767	1.000	
HUMANK	.0248	-.0895	-.0579	-.1830	.1102	1.000

Note: All variables are represented in logarithmic form, except for XM.

5. EMPIRICAL RESULTS

5.1 Baseline Estimations

Having depicted our empirical framework and estimation, we then obtained the parameter estimates of the econometric specifications. Table 5 shows the baseline estimates of Levinsohn-Petrin TFP as in Specifications (2) and (3). The OLS estimates encompass the heteroskedasticity-robust estimators. As stressed in the previous section, OLS estimates tend to be biased and inconsistent, at least asymptotically, due to unobservable firm heterogeneity and potential endogeneity biases. The fixed effects (FE) and random effects (RE) estimates control for the unobserved firm characteristics. To control for potential endogeneity biases, the dynamic model of Levinsohn-Petrin TFP, as in Specification (4) is given in Table 6, where the logged dependent variable is included as a regressor, and the logged right-hand variables are chosen as IVs. As

[7] We also considered the interaction between financial health variables and other explanatory variables, in addition to foreign ownership. Our main findings are qualitatively unchanged. The results are available upon request.

suggested by Bond et al. (2001), we also performed an additional empirical check by producing OLS and FE estimates for Specification (4) with the logged dependent variable (Table 6). The two-step Blundell-Bond GMM estimates address the potential endogeneity problem, whereby the control variables are instrumented by their logs. As Table 6 shows, our main results are qualitatively robust except for the coefficient of human capital ($\ln HUMANK_{it}$), which becomes statistically insignificant in the FE estimations. However, as is well known, the OLS estimate of the logged autoregressive parameter is biased upwards, while the FE estimate is biased downwards. Therefore, the following discussions of our main results are based on the GMM estimates in Table 6, which are consistent with the baseline estimates in Table 5. Lastly, we also performed a sensitivity check by incorporating the interaction between financial health variables and foreign ownership.

Table 5: Baseline Estimations of Levinsohn-Petrin TFP

Independent Variable	OLS		Fixed Effects		Random Effects	
Constant	.5917(.8918)	.6413(.9147)	−2.439(1.877)	−2.362(1.816)	.1104(.9080)	.1917(.9317)
$\ln LIQUIDITY_{it}$	1.582^{***}(.2955)	1.36^{***}(.5136)	1.559^{***}(..4621)	1.353(.9472)	1.598^{***}(.302)	1.370^{**}(.5731)
$\ln LEVERAGE_{it}$	$.1854^{***}$(.0586)	$.2610^{*}$(.1435)	$.1498^{**}$(.0634)	$.482^{**}$(.2016)	$.1767^{***}$(.0528)	$.2962^{**}$(.1404)
$\ln SIZE_{it}$	$.7906^{***}$(.1187)	$.7767^{***}$(.1203)	1.280^{***}(.2447)	1.282^{***}(.2386)	$.8770^{***}$(.1226)	$.8626^{***}$(.1243)
$\ln COM_{it}$	$.7936^{***}$(.1396)	$.7920^{***}$(.1441)	$.7310^{***}$(.1521)	$.7173^{***}$(.1506)	$.7782^{***}$(.1286)	$.7746^{***}$(.1311)
$\ln HUMANK_{it}$	$.3688^{**}$(.1722)	$.3886^{**}$(.1650)	$.5850^{**}$(.2734)	$.5986^{**}$(.252)	$.4043^{**}$(.1785)	$.4247^{**}$(.1648)
$\ln FOWN_{it}$	$.4883^{***}$(.1092)	$.4456^{***}$(.1657)	1.088^{***}(.2893)	1.125^{***}(.337)	$.5768^{***}$(.1192)	$.5423^{***}$(.1775)
$\ln FOWN_{it} \times \ln LIQUIDITY_{it}$	----	−.0770(.1200)	----	−.0466(.2135)	----	−.0765(.1365)
$\ln FOWN_{it} \times \ln LEVERAGE_{it}$	----	.0184(.0270)	----	$.0776^{*}$(.0408)	----	.0290(.0279)
No. Obs.	861	861	861	861	861	861
R-squared	.1828	.1839	.1582	.1557	.1819	.1827
Wald's Chi-squares	----	----	----	----	128.72^{***}	145.18^{***}
Breusch-Pagan Test	----	----	----	----	5.76^{***}	5.77^{***}

No. Obs. = number of observations, OLS = ordinary least squares.

Note: (1) Heteroskedasticity-robust standard errors are shown in parentheses; (2) ***, ** and *: statistically significant at the 1%, 5% and 10% levels, respectively; (3) the Random Effects estimates are based on the Generalized Least Squares (GLS) with Swamy-Arora estimators; and (4) the Breusch-Pagan test is Chi-squared distributed under the null hypothesis that there are no random effects.

Our results are strikingly robust. All estimations and specifications, as shown in Tables 5 and 6, yield qualitatively identical results, suggesting that the problems of unobserved firm heterogeneity and potential endogeneity may not pose serious challenges to our empirical framework. In particular, the Breusch-Pagan statistics advocate the use of RE estimates. The data are statistically significant at 1%, rejecting the null hypothesis that there are no random effects. The Sargan data are statistically insignificant, thus pointing to the validity of over-identifying restrictions under GMM estimations; that is, our econometric, in which the logged endogenous variables are treated as exogenous, is appropriate and well-specified.[8] The standard Arellano-Bond (AR) test consistently suggests that the null hypothesis of no serial correlation cannot be rejected. In addition, when the interaction terms are included, our main findings are qualitatively unchanged, suggesting that the multicollineraity of financial health variables may be inconsequential, if not absent altogether. Our main findings can be recapitulated as follows.

[8] Some slight sensitivity is observed. In the specification without the interaction terms, Sargan data appears to be statistically significant, albeit only at the 10% level. However, when the interaction terms are included Sargan data becomes statistically insignificant.

Table 6: Estimations of Levinsohn-Petrin TFP with the Logged Dependent Variable

Independent Variable	OLS		Fixed Effects		GMM	
Constant	$-1.118(1.554)$	$-.6752(1.642)$	$.5951(2.339)$	$.7198(2.318)$	$.2326(2.118)$	$1.104(2.365)$
TFP_{it-1}^{L-P}	$.1095^{**}(.0480)$	$.1073^{**}(.0474)$	$-.2407^{**}(.0977)$	$-.2408^{**}(.0965)$	$-.0798(.1130)$	$-.0162(.144)$
$\ln LIQUIDITY_{it}$	$1.708^{***}(.4851)$	$2.223^{**}(1.099)$	$1.703^{***}(.5452)$	$1.925^{**}(.8072)$	$1.329^{***}(.3877)$	$1.648^{**}(.6884)$
$\ln LEVERAGE_{it}$	$.1576^{**}(.0742)$	$.2842(.1852)$	$.1380^{**}(.0657)$	$.2002(.1577)$	$.1492^{**}(.0598)$	$.3958^{**}(.1725)$
$\ln SIZE_{it}$	$.8813^{***}(.2276)$	$.8702^{***}(.2282)$	$.8873^{***}(.2267)$	$.8941^{***}(.2274)$	$.8915^{***}(.2150)$	$.8552^{***}(.231)$
$\ln COM_{it}$	$.8072^{***}(.2552)$	$.7854^{***}(.2707)$	$.6233^{***}(.2141)$	$.6207^{***}(.2129)$	$.7177^{***}(.1332)$	$.9924^{***}(.308)$
$\ln HUMANK_{it}$	$.6064^{**}(.2520)$	$.6151^{**}(.2580)$	$.3838(.3464)$	$.3680(.3490)$	$.7467^{**}(.3515)$	$.8518^{*}(.4631)$
$\ln FOWN_{it}$	$.4029^{**}(.1685)$	$.5003^{*}(.2706)$	$.7239^{***}(.2331)$	$.7933^{***}(.2510)$	$.7081^{***}(.2206)$	$.5645^{*}(.3005)$
$\ln FOWN_{it} \times \ln LIQUIDITY_{it}$	----	$.1321(.2100)$	----	$.0697(.1450)$	----	$-.0990(.1977)$
$\ln FOWN_{it} \times \ln LEVERAGE_{it}$	----	$.0290(.0309)$	----	$.0165(.0348)$	----	$.0487(.0375)$
Number of Observations	380	380	380	380	380	380
R-squared	.2056	.2089	.1125	.1142	----	----
Wald's Chi-squares	----	----	----	----	96.07^{***}	71.85^{***}
Number of IVs	----	----	----	----	17	16
Sargan Test	----	----	----	----	15.17 ($p = .0863$)	7.21 ($p = .3021$)
AR Test	----	----	----	----	$-.4627$ ($p = .6436$)	$-.7653$ ($p = .4441$)

OLS = ordinary least squares.

Note: (1) Heteroskedasticity-robust standard errors are shown in parentheses; (2) ***, ** and *: statistically significant at the 1%, 5%, and 10% levels, respectively; (3) the Random Effects estimates are based on the Generalized Least Squares (GLS) with Swamy-Arora estimators; (4) the Bond-Blundell estimates are based on the Generalized Method of Moment (GMM) with two-step estimators and the maximum log for AR tests equal to two; (5) the Sargan test is chi-squared distributed under the null hypothesis that over-identifying restrictions are valid; and (6) the Arellano-Bond (AR) test reports z-scores under the null hypothesis of no serial correlation.

Foremost, we have found compelling and consistent data that financial health contributes positively to the TFP of firms in Viet Nam. The parameter estimates associated with $\ln LIQUIDITY_{it}$ and $\ln LEVERAGE_{it}$ are statistically significant at the 1% or 5% levels across all estimations. Notwithstanding a modest sensitivity of the coefficient of $\ln LIQUIDITY_{it}$ under the FE estimation to become insignificant when the interaction terms are included, the Breusch-Pagan test points to the presence of random effects and, consequently, is in favor of the RE estimates as opposed to the FE estimates (see Table 5). Firms with sound financial health, either in terms of high liquidity or sufficient access to external credit, tend to demonstrate superior productivity. Intuitively, firms that run on greater liquid assets and larger external sources of funds are more resilient to financial distress and stand to thrive on new business opportunities and materialize higher productivity performance. The empirical findings substantiate Levine's (2005) argument that financial characteristics shape a firm's growth prospects through market selection mechanisms and investment decisions. In addition, our evidence corroborates the literature documenting the effects of financial attributes on various aspects of firm performance. For instance, Beck et al. (2005) and Demirguc-Kunt and Maksimovic (1998) posit that liquidity helps ease obstacles facing firms and augments firm growth. Becchetti and Trovato (2002) reported that limited access to external credit imposes constraints on firm development, innovation and overall investment decisions. We further find that liquidity and leverage matter to firm productivity.

Economies of scale – the extent to which larger firms demonstrate superior productivity performance – are observed among firms in Viet Nam. The coefficients of $\ln SIZE_{it}$ consistently appear positive and statistically significant at the 1% level across all estimations and specifications. The presence of economies of scale among Vietnamese firms may be explained by the increasing returns to scale associated with the log-linearized Cobb-Douglas technology reported in Table 2. Investment in high-tech and human capital appears to be vital to TFP. The coefficients of $\ln COM_{it}$ and $\ln HUMANK_{it}$ are also positive and statistically significant across all estimations and specifications. This data sheds light on the accumulation of high-tech capital, such as computers and automated machines, and investment in human resources as key driving factors of productivity among firms in Viet Nam. Finally, firms with a higher proportion of foreign ownership are likely to enjoy a higher level of TFP, as the coefficients of $\ln FOWN_{it}$ are positive and statistically significant. The positive correlation between foreign ownership and TFP is consistent with reports by Arnold and Javorcik (2009) and Girma and Görg (2007), who relate productivity variation to type of ownership, e.g. foreign-owned versus domestic firms, and find that multinational firms tend to outperform domestic firms. Our current findings clarify the role of foreign ownership by showing that *foreign* direct investment (FDI) brings about higher levels of productivity performance.

5.2 The Roles of International Trade

A natural extension of our base-line empirical framework leads to the research inquiry – does exposure to international trade matter to the effects of financial health on firm productivity? Our hypothesis is that the productivity of firms with exporting and/or importing activities may be sensitive to financial health in a way different from that of firms that deal only with domestic markets. This hypothesis comes from the fact that exporting and importing activities count primarily on extra sources of trade finance such as import and export credit and guarantees, and thus any link between financial health and firm productivity is expected to be exaggerated for exporting and importing firms. To test this theory, we partitioned our firm samples into two groups, with and without exposure to international trade, and obtained the parameter estimates based on our empirical framework.

Table 7 shows the GMM estimations of the Levinsohn-Petrin TFP. The left side contains estimates of firms with international trade, while the right side shows the figures for firms with no importing and exporting activities. Although our key results are still qualitatively valid under OLS, FE and RE estimations, we choose to report only the GMM estimates. This is because GMM accounts for the potential endogeneity biases, and the validity of the over-identifying restrictions under the Sargan test imply that a model with the logged control variables chosen as IVs is well identified, and thus tends to generate GMM estimates that are unbiased and consistent. As before, the AR test implies that the serial correlation does not pose a problem in our estimations.

Table 7: GMM Estimations of Levinsohn-Petrin TFP by International Trade Status

Dependent variable: TFP_{it}^{L-P}				
Independent Variable	**Firms with Int. Trade**		**Firms without Int. Trade**	
Constant	$-.1578(2.302)$	$-.1703(2.305)$	$11.93^{***}(.8225)$	$10.71^{**}(2.146)$
TFP_{it-1}^{L-P}	$-.0513(.1430)$	$-.0407(.1495)$	$.1293^{**}(.0638)$	$.2279^{*}(.1102)$
$\ln LIQUIDITY_{it}$	$1.768^{***}(.5406)$	$1.573^{**}(.7899)$	$7.779^{***}(.6128)$	$10.61^{***}(1.552)$
$\ln LEVERAGE_{it}$	$.1773^{***}(.0757)$	$.2869^{*}(.1535)$	$.0652^{**}(.0328)$	$.1363(.1541)$
$\ln SIZE_{it}$	$.9107^{***}(.2330)$	$.9052^{***}(.2262)$	$-.0484(.0866)$	$.3133(.2273)$
$\ln COM_{it}$	$.8595^{***}(.2631)$	$.8906^{***}(.2777)$	$1.279^{***}(.0806)$	$1.164^{***}(.1182)$
$\ln HUMANK_{it}$	$.3945(.3452)$	$.4097(.3577)$	$4.171^{***}(.2504)$	$4.411^{***}(.3147)$
$\ln FOWN_{it}$	$.6210^{**}(.2286)$	$.5820^{**}(.2655)$	$-1.073^{***}(.0678)$	$-.2289(.4644)$
$\ln FOWN_{it} \times \ln LIQUIDITY_{it}$	----	$-.0585(.1701)$	----	$.7597^{*}(.4199)$
$\ln FOWN_{it} \times \ln LEVERAGE_{it}$	----	$.0260(.0399)$	----	$.0093(.0338)$
No. Obs.	268	268	112	112
Wald's Chi-squares	50.81^{***}	56.55^{***}	1863.48^{***}	1308.77^{***}
Number of IVs	12	14	12	14
Sargan Test	4.517($p=.341$)	4.56($p=.335$	3.097($p=.542$)	1.96($p=.744$)
AR Test	$.8070(p=.4197)$	$.8007(p=.423)$	$-.8661(p=.386)$	$.3724(p=.7096)$

Note: (1) Heteroskedasticity-robust standard errors are shown in parentheses; (2) ***, ** and *: statistically significant at the 1%, 5%, and 10% levels, respectively; (3) the Bond-Blundell estimates are based on the Generalized Method of Moment (GMM) with two-step estimators and the maximum log for Arellano-Bond (AR) tests equal to two; (4) the Sargan test is chi-squared distributed under the null hypothesis that over-identifying restrictions are valid; and (5) the AR test reports z-scores under the null hypothesis of no serial correlation.

Our finding that liquidity enhances firm productivity appears to be robust, as the coefficients of $\ln LIQUIDITY_{it}$ remain positive and statistically significant across all estimations and specifications. A comparison of the magnitude of the coefficient further reveals that the effects of liquidity on TFP are more pronounced on firms with no exposure to international markets than on those with international trade. Interestingly, the coefficients of $\ln LEVERAGE_{it}$ are statistically significant for firms with foreign trade exposure while the access to external credit does not seem to boost productivity among firms without exports and imports. This may be explained by the fact that, in contrast to firms not engaged in international trade, exporting and importing firms require additional external credit, e.g. trade finances, and therefore one might expect that exposure to exporting and importing activities would bolster any effects of external financial sources on firm productivity.

Economies of scale characterize firms with links to international markets, but not non-exporting and non-importing firms. As shown in Table 7, the coefficients of firm size ($\ln SIZE_{it}$) turn out to be positive and statistically significant only for firms with international trade, whereas the correlation is insignificant for firms without exporting and importing activity. On the other hand, high-tech capital accumulation fuels TFP for both types of firms, as the coefficients of $\ln COM_{it}$ are positive and strongly significant for all sub-groups. In contrast, human capital investment ($\ln HUNMANK_{it}$) impacts TFP only for firms dealing with domestic markets. Lastly, foreign ownership serves as a driving force for productivity among firms tied to international markets, but not for domestic market firms. Specifically, the coefficients of $\ln FOWN_{it}$ are positive and statistically significant for firms with international trade. The effects of foreign ownership on firm productivity for firms without exporting and importing activity appear to be negative, while the statistical significance is rather sensitive to econometric specifications. This result may not be surprising since foreign ownership allows exporting and importing firms to tap deeper and wider networks with international markets and thus unleash higher levels of productivity.

6. CONCLUSIONS

The present paper empirically investigates the effects of financial health on firm productivity, employing micro-level panel data from firms in Viet Nam from 2002 to 2008. Our empirical framework of the Levinsohn-Petrin TFP builds upon a well-established body of literature that pertains to the determinants of firm productivity, and incorporates the proxies of financial health, namely liquidity intensity and access to external credit. The parameter estimates provide rather strong and robust evidence that financial health holds the key to exceptional firm productivity. More specifically, firms operating in an environment with more liquidity and access to external sources of finances demonstrate superior productivity. In summary, our findings provide a clearer insight into the real economic gains achievable by improving financial health, and add a new dimension of financial characteristics to firm productivity and performance.

Some policy implications can also be drawn from our findings. Financial market development offers a crucial impetus for enhancing firm competitiveness and catalyzing industrialization. On the one hand, a well-functioning financial market allows firms to embark on new business opportunities and make optimal investment decisions. Sufficient liquidity and sources of financing, on the other hand, are a prerequisite for resilience to external shocks and survival in the markets. In the context of emerging markets like Viet Nam, firms typically encounter serious financial distortions, financing mismatches and inadequate financial institutions and infrastructure, which in turn impose constraints on firm productivity and performance. Therefore, if the policymakers' objective is to enhance the productivity of firms, a well-functioning financial market with financial resources effectively allocated at minimal costs has to be implemented.

REFERENCES

Aghion, P., T. Fally, and S. Scarpetta. 2007. Credit Constraints as a Barrier to the Entry and Post-entry Growth of Firms. Economic Policy *22: 731–119.*

Alfaro, L., A. Chandab, S. Kalemli-Ozcanc, S. Sayek. 2004. FDI and Economic Growth: The Role of Local Financial Markets. *Journal of International Economics* 64: 89–112.

Alfaro, L., A. Chanda, S. Kalemli-Ozcan, and S. Sayek. 2006. How Does Foreign Direct Investment Promote Economic Growth?: Exploring the Effects of Financial Markets on Linkages. *Department of Economics Working Paper* 07–013. Cambridge, MA: Harvard University.

Anwar, S., and L. P. Nguyen. 2012. Financial Development and Economic Growth in Vietnam. Journal of Economics and Finance *35(3): 348–360.*

Arellano, M., and O. Bover.1995. Another Look at the Instrumental-Variable Estimation of Error-Components Models. Journal of Econometrics *68: 29–52.*

Arnold, J.M., and B.S. Javorcik. 2009. Gifted Kids or Pushy Parents? Foreign Direct Investment and Plant Productivity in Indonesia. Journal of International Economics *79: 42–53.*

Ayyagari, M., *A. Demirguc-Kunt, and* V. Maksimovic. 2010. Formal versus Informal Finance: Evidence from China. *Review of Financial Studies* 23: 3048–3097.

Balk, B.M. 2001. Scale Efficiency and Productivity Change. Journal of Productivity Analysis *15: 159–183.*

Beck, T., A. Demirguc-Kunt, and V. Maksimovic. 2005. Financial and Legal Constraints to Firm Growth: Does Firm Size Matter? Journal of Finance *60: 137–177.*

Benfratello, L., and A. Sembenelli. 2006. Foreign Ownership and Productivity: Is the Direction of Causality So Obvious? International Journal of Industrial and Organization *24: 733–751.*

Blundell, R., and S. Bond. 2000. GMM Estimation with Persistent Panel Data: An Application to Production Functions. Econometric Review *19: 321–340.*

Bond, S., A. Hoeffler, and J. Temple. 2001. GMM Estimation of Empirical Growth Models *CEPR Discussion Paper Series 3048.*

Demirguc-Kunt, A., and V. Maksimovic. 1998. Law, Finance, and Firm Growth. *The Journal of Finance* 53: 2107–2137.

Girma, S., and H. Görg. 2007. Multinationals' Productivity Advantage: Scale or Technology? Economic Inquiry *45: 350–362.*

Girma, S., H. Görg, and E. Strobl. 2004. Exports, International Investment, and Plant Performance: Evidence from A Non-parametric Test. Economics Letters *83: 317–324.*

Griffith, R. 1999. Using the ARD Establishment Level Data to Look at Foreign Ownership and Productivity in the United Kingdom. Economic Journal *109: F416–F442.*

Griliches, Z., and J. Mairesse. 1998. Production Functions: The Search for Identification. In Econometrics and Economic Theory in the Twentieth Century:

The Ragna Frisch Centennial Symposium, pp. 169–203, edited by*0020*S. Strøm. New York: Cambridge University Press.

Levine, R. 2005. Finance and Growth: Theory and Evidence. In *Handbook of Economic Growth Vol. 1*, pp. 865–934, edited by P. Aghion and S. Durlauf. Amsterdam: North-Holland.

Levinsohn, J., and A. Petrin. 2003. Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies* 70: 317–341.

Morrison, C., and E.R. Berndt. 1991.Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing Industries. *National Bureau of Economic Research Working Paper* 3582. Cambridge, MA: NBER.

Oliner, S., and D. Sichel. 1994. Computers and Output Growth Revisited: How Big Is the Puzzle? *Brooking Papers on Economic Activity* 1994: 273–334.

Oliner, S., and D. Sichel. 2000. "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" *Journal of Economic Perspectives* , Vol. 14:, pp. 3–22.

Olley, S., and A. Pakes. 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica* 64: 1263–1289.

Siegel, D., and Z. Griliches. 1992. Purchased Services, Outsourcing, Computers, and Productivity in Manufacturing. *National Bureau of Economic Research Working Paper* 3678; *Output Measurement in the Service Sector,* edited by Z. Griliches. Chicago: University of Chicago Press.

World Bank. 2006. Overview of the Capital Markets in Viet Nam and Directions for Development. http://siteresources.worldbank.org/INTVIETNAM/Resources/Overview_of_the_Capital_Markets_in_Viet Nam.pdf.