Internet Appendix for "Financial development and labor market outcomes: Evidence from Brazil"

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Appendix A Production function estimation

Our production function estimation procedure closely follows De Loecker and Warzynski (2012). Consider the following production function

$$q_{it} = f(s_{it}, n_{it}, k_{it}; \gamma) + \omega_{it} + \varepsilon_{it} \tag{1}$$

where q_{it} is logged value added, s_{it} is logged skilled labor, n_{it} is logged unskilled labor, k_{it} is logged capital, γ collects all coefficients, and ω_{it} is logged physical productivity (TFPQ). Our baseline specification relies on a translog functional form for $f()$, which is equivalent to approximating $f()$ by a second-order polynomial in which all inputs, inputs squared, and interaction terms between all inputs are included (in log form). We consider a translog production function of the form

$$q_{it} = \gamma_s s_{it} + \gamma_n n_{it} + \gamma_k k_{it} + \sum_{x \in \{s,n,k\}} \gamma_{xx} x_i^2 + \sum_{w \neq x} \sum_{x \in \{s,n,k\}} \gamma_{xw} x_{it} w_{it} + \omega_{it} + \varepsilon_{it} \tag{2}$$

To consistently estimate production function coefficients, we need to control for unobserved productivity shocks since those are potentially correlated with input choices. We deal with this issue by relying on proxy methods developed by Olley and Pakes (1996) and Levinsohn and Petrin (2003) and use material demand

$$m_{it} = m_t(k_{it}, \omega_{it}, s_{it}, n_{it}) \tag{3}$$

to proxy for productivity by inverting $m_t()$. We hence assume that the demand for materials is strictly monotone in ω_{it}.

We follow Ackerberg et al. (2015) and estimate all relevant coefficients using second-stage moments, instead of attempting to identify labor coefficients in the first stage as in Levinsohn and Petrin (2003).[1] In the first stage, we estimate

$$q_{it} = \phi(s_{it}, n_{it}, k_{it}, m_{it}) + \varepsilon_{it} \tag{4}$$

and obtain an estimate of expected output ($\hat{\phi}$) and an estimate of ε_{it}. In the second stage, we rely on the assumed law of motion for productivity

$$\omega_{it} = g_t(\omega_{it}) + \xi_{it} \tag{5}$$

For a given set of parameters γ, we can compute $\omega_{it}(\gamma) = \hat{\phi} - \gamma_s s_{it} - \gamma_n n_{it} - \gamma_k k_{it} - \sum_{x \in \{s,n,k\}} \gamma_{xx} x_{it} - \sum_{z \neq x} \sum_{x \in \{s,n,k\}} x_{it} w_{it}$. We can then regress $\omega_{it}(\gamma)$ on its lag and recover the innovation to productivity (conditional on the set of parameters γ) $\xi_{it}(\gamma)$. We then estimate the production function parameters using Generalized Method of Moments (GMM) and moment conditions of the form

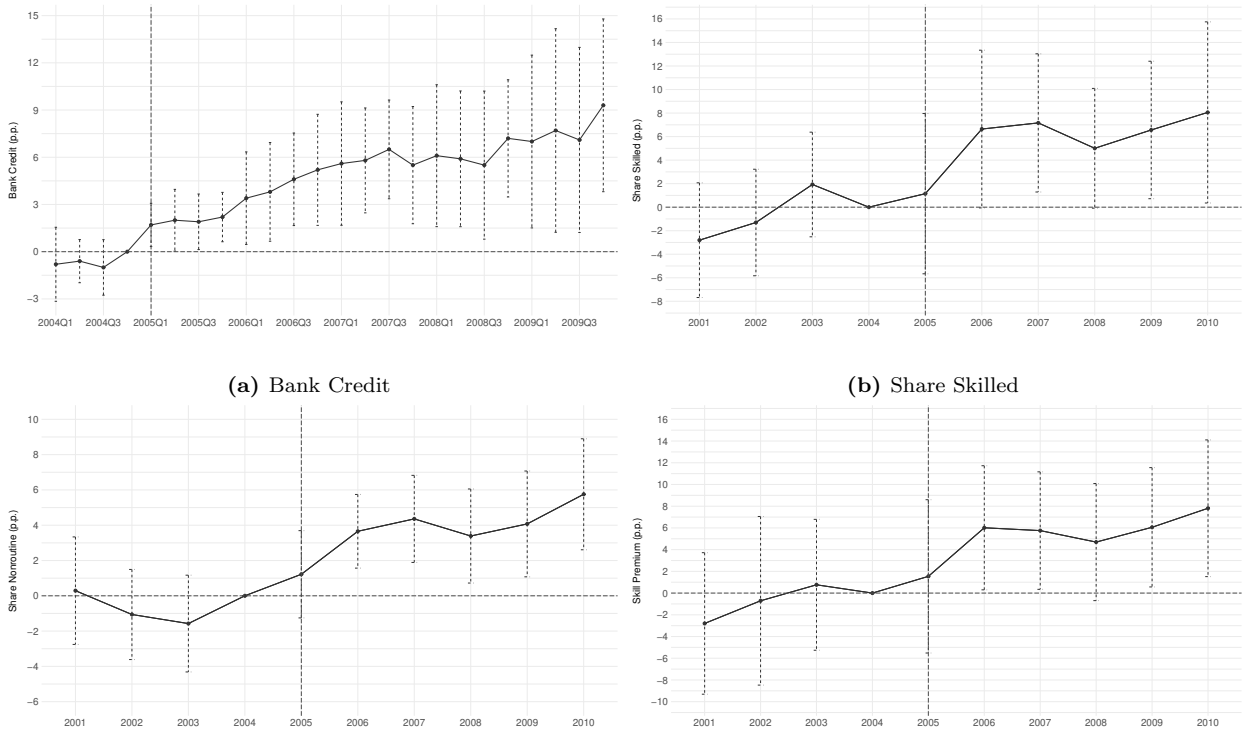
$$\mathbb{E}[\xi_{it}(\gamma) z^j] = 0 \; j \; \in \; \{s, n, k\}$$
$$\mathbb{E}[\xi_{it}(\gamma) z^j z^h] = 0 \; j, h \; \in \; \{s, n, k\}$$

[1] See Ackerberg et al. (2015) and Wooldridge (2009) for a discussion of the issues with this approach.

where z^j, $j \in \{s, n, k\}$, is an instrument for skilled labor, unskilled labor, capital, or materials. We assume capital is decided one period ahead and is thus not correlated with the innovation in productivity. Under that assumption, we can use capital as its own instrument. We use lagged skilled and unskilled labor as instruments for skilled and unskilled labor, respectively. In order for these instruments to be valid, we require that skilled and unskilled wages be correlated over time, an assumption that is supported by our data.

We measure value added as the difference between deflated net revenue and deflated intermediate inputs, and measure materials as the deflated value of intermediate inputs. We measure skilled labor as the number of workers with at least some college education and unskilled labor as the number of workers with no college education. Finally, we measure capital as the deflated book value of fixed assets.

Appendix B Additional results



(a) Bank Credit

(b) Share Skilled

(c) Share Nonroutine

(d) Skill Premium

Appendix Figure B1: Timing of effect by degree of capital-skill complementarity

This figure shows the timing of the effect of the 2005 bankruptcy reform on bank credit (Panel A), on the share of skilled workers (Panel B), on the share of workers in managerial, professional, and technical occupations (Panel C), and on the skill premium (Panel D). We plot coefficient estimates and 95% confidence intervals from a dynamic version of Eq. (19), in which we replace the $Reform_t$ dummy with a dummy for each time period, with dependent variables in growth rates. Bank Credit is the sum of all outstanding bank loans for a given firm in a given quarter-year. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Observation is at the firm-quarter-year level in Panel A and at the firm-year level in the remaining panels. Standard errors are clustered at the AMC level. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Credit registry data is available from 2003 onward at a quarterly frequency and employment outcomes are available from 2000 onward at an annual frequency.

(a) Bank Credit

(b) Share Skilled

(c) Share Nonroutine

(d) Skill Premium

Appendix Figure B2: Timing of effect by firm size

This figure shows the timing of the effect of the 2005 bankruptcy reform on bank credit (Panel A), on the share of skilled workers (Panel B), on the share of workers in managerial, professional, and technical occupations (Panel C), and on the skill premium (Panel D). We plot coefficient estimates and 95% confidence intervals from a dynamic version of Eq. (20), in which we replace the $Reform_t$ dummy with a dummy for each time period, with dependent variables in growth rates and $Constrained_i$ given by a dummy for a firm being smaller than the median firm. Bank Credit is the sum of all outstanding bank loans for a given firm in a given quarter-year. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Observation is at the firm-quarter-year level in Panel A and at the firm-year level in the remaining panels. Standard errors are clustered at the AMC level. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Credit registry data is available from 2003 onward at a quarterly frequency and employment outcomes are available from 2000 onward at an annual frequency.

(a) Bank Credit

(b) Share Skilled

(c) Share Nonroutine

(d) Skill Premium

Appendix Figure B3: Timing of effect by firm age

This figure shows the timing of the effect of the 2005 bankruptcy reform on bank credit (Panel A), on the share of skilled workers (Panel B), on the share of workers in managerial, professional, and technical occupations (Panel C), and on the skill premium (Panel D). We plot coefficient estimates and 95% confidence intervals from a dynamic version of Eq. (20), in which we replace the $Reform_t$ dummy with a dummy for each time period, with dependent variables in growth rates and $Constrained_i$ given by a dummy for a firm being younger than the median firm. Bank Credit is the sum of all outstanding bank loans for a given firm in a given quarter-year. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Observation is at the firm-quarter-year level in Panel A and at the firm-year level in the remaining panels. Standard errors are clustered at the AMC level. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Credit registry data is available from 2003 onward at a quarterly frequency and employment outcomes are available from 2000 onward at an annual frequency.

Appendix Table B1: Effect on credit and investment by degree of capital-skill complementarity

Dependent Variable:	Bank Credit		Investment/Assets	
	(1)	(2)	(3)	(4)
Reform×HighEnforcement×HighCSC	**0.058****	**0.053*****	**0.041*****	**0.038*****
	(0.017)	(0.016)	(0.017)	(0.015)
Reform×HighCSC	0.001	0.010	-0.012	0.015
	(0.015)	(0.020)	(0.019)	(0.025)
Firm FE	Yes	Yes	Yes	Yes
AMC-Year FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (16), with all dependent variables in growth rates. Bank Credit is the sum of all outstanding bank loans for a given firm. Investment/Assets is total capital expenditures divided by lagged assets. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. The regressions in columns 1 and 2 include 2,907,501 firm-quarter-year observations and the regressions in columns 3 and 4 include 227,920 firm-year observations. The number of observations differs across regressions because real outcomes such as investment are only available for firms in extractive and manufacturing sectors with at least 30 employees and at a yearly frequency. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B2: Robustness to different measures of capital-skill complementarity

Dependent Variable:	Share Skilled		Share Nonroutine		Skill Premium	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform×HighEnforcement×HighCSC$_1$	**0.055*****		**0.027****		**0.058*****	
	(0.011)		(0.010)		(0.010)	
Reform×HighEnforcement×HighCSC$_2$		**0.041****		**0.018**		**0.036****
		(0.015)		(0.011)		(0.014)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
AMC-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (19), with all dependent variables in growth rates. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. High CSC$_1$ is a dummy for a firm being in an industry that is above the median according to the capital-skill complementarity measure in Larrain (2015). High CSC$_2$ is a dummy for a firm being in an industry in the manufacturing sector. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Regressions in odd-numbered columns include 1,670,813 firm-year observations and regressions in even-numbered columns include 2,373,611 firm-year observations. The difference in the number of observations is due to the fact that the Larrain (2015) measure of capital-skill complementarity is not available for all sectors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B3: Effect on credit and investment by degree of financial constraints

Dependent Variable:	Bank Credit		Investment/Assets	
	(1)	(2)	(3)	(4)
Reform×HighEnforcement×Small	**0.062*****		**0.041****	
	(0.019)		(0.015)	
Reform×HighEnforcement×Young		**0.039****		**0.032****
		(0.015)		(0.013)
Firm FE	Yes	Yes	Yes	Yes
AMC-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (20), with all dependent variables in growth rates. Bank Credit is the sum of all outstanding bank loans for a given firm. Investment/Assets is total capital expenditures divided by lagged assets. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. The regressions in columns 1 and 2 include 2,907,501 firm-quarter-year observations and the regressions in columns 3 and 4 include 227,920 firm-year observations. The number of observations differs across regressions because real outcomes such as investment are only available for firms in extractive and manufacturing sectors with at least 30 employees and at a yearly frequency. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B4: Robustness to controlling for industry-specific trends

Dependent Variable:	Share Skilled		Share Nonroutine		Skill Premium	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform×HighEnforcement	**0.030*****	**0.028*****	**0.026*****	**0.022*****	**0.031*****	**0.027*****
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (16) including 2-digit-industry×time fixed effects, with all dependent variables in growth rates. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Industry refers to 2-digit industry fixed effects. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Each regression includes 2,373,611 firm-year observations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B5: Robustness to controlling for funding needs

Dependent Variable:	Share Skilled		Share Nonroutine		Skill Premium	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform×HighEnforcement	**0.040*****	**0.025*****	**0.022****	**0.015**	**0.039*****	**0.021*****
	(0.008)	(0.008)	(0.008)	(0.010)	(0.007)	(0.007)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Funding Need Controls	No	Yes	No	Yes	No	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (16), with all dependent variables in growth rates. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Baseline controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Baseline control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Funding need controls include log employment (measured in 2004 and interacted with the $Reform_t$ dummy) and firm age. Each regression includes 2,373,611 firm-year observations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table B6: Robustness to using logs instead of growth rates

Dependent Variable:	Share Skilled		Share Nonroutine		Skill Premium	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform×HighEnforcement	**0.021*****	**0.020*****	**0.018*****	**0.023*****	**0.009*****	**0.011*****
	(0.006)	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes

Notes: All columns report estimates of the linear regression model specified in Eq. (16), with all dependent variables in logs. Share Skilled is the ratio of skilled workers to total employment, with a worker being categorized as skilled if possessing at least some post-secondary education. Share Nonroutine is the ratio of managers, professionals, and technicians to total employment. Skill Premium is the ratio of average hourly wages of high- and low-skilled workers. We adjust wages for composition using Mincer regressions of log wages on gender, age, tenure, age squared, and tenure squared. Standard errors, clustered at the AMC level, are reported in parentheses. The bottom rows specify the fixed effects and controls included in each column. Controls include local GDP per capita, the share of manufacturing in local value added, the number of bank branches per 100,000 people, and the firm-level share of skilled workers. Control variables are measured in 2004, the year prior to the reform, and interacted with the $Reform_t$ dummy. Each regression includes 2,044,035 firm-year observations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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