Trade Costs and Job Flows: Evidence from Establishment-Level Data

Appendix — For Online Publication

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A A Model of Input Trade and Firm-Level Employment

This section presents the details of the model outlined in section 2.2. We assume a country with a differentiated-good sector and a homogeneous-good sector. Firms in the differentiated-good sector are heterogeneous in productivity. The homogeneous-good sector employs only domestic labor, but firms in the differentiated-good sector can take advantage of lower input prices abroad.

A.1 Preferences and Demand

The total size of the workforce is $\mathbb{L}$, which is also the number of households. Households' preferences are defined over a continuum of differentiated goods and a homogeneous good. In particular, the utility function for the representative consumer is given by

$$\mathbb{U} = H + \frac{\eta}{\eta - 1} Z^{\frac{\eta-1}{\eta}}, \tag{A-1}$$

where H denotes the consumption of the homogeneous good, $Z = \left(\int_{\omega \in \Omega} z^c(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}$ is the CES consumption aggregator of differentiated goods, and $\eta > 1$ is the elasticity of demand for Z (η governs the substitutability between homogenous and differentiated goods). In Z, $z^c(\omega)$ denotes the consumption of variety ω, Ω is the set of differentiated goods available for purchase, and $\sigma > 1$ is the elasticity of substitution between varieties. We assume that $\sigma > \eta$ so that differentiated-good varieties are better substitutes for each other than for the homogeneous good. The homogeneous good is the numeraire (its price is 1).

For differentiated goods, the representative household's demand for variety ω is given by $z^c(\omega) = \frac{p(\omega)^{-\sigma}}{P^{1-\sigma}} PZ$, where $p(\omega)$ is the price of variety ω, $P = \left[\int_{\omega\in\Omega} p(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$ is the price of the CES aggregator Z, and hence, PZ is the household expenditure on differentiated goods. Given the quasi-linear utility in (A-1), it follows that $Z = P^{-\eta}$, and therefore, the aggregate demand for variety ω is given by

$$z^d(\omega) = p(\omega)^{-\sigma} P^{\sigma-\eta} \mathbb{L}. \tag{A-2}$$

The homogeneous good, H, is produced by perfectly competitive firms using domestic labor only. In addition, one unit of domestic labor produces one unit of the homogeneous good. This fixes the domestic wage at 1 as long as some homogenous good is produced, which we assume to be the case. Therefore, the income of each household simply equals 1. We assume that the parameters are such that $PZ \equiv P^{1-\eta} < 1$, so that a typical household has enough income to buy all differentiated goods.

A.2 Production and Pricing in the Differentiated-Good Sector

The productivity of a differentiated-good firm is denoted by φ. As in Melitz (2003), each firm must pay a sunk entry cost of f_E in units of the numeraire, after which it will draw its productivity from a cumulative distribution function given by $G(\varphi)$ (the probability density function is denoted by $g(\varphi)$).

The production function of a firm with productivity φ is $z(\varphi) = \varphi Y$, with

$$Y = \left[\alpha L^{\frac{\rho-1}{\rho}} + (1-\alpha) M^{\frac{\rho-1}{\rho}}\right]^{\frac{\rho}{\rho-1}}, \tag{A-3}$$

where L is a composite of inputs produced *within* the firm, M is a composite of inputs procured from *outside* the firm, and $\rho \geq 0$ is the elasticity of substitution/complementarity between the two types of inputs. We assume that one unit of labor is required to produce one unit of L, so that L is directly interpreted as domestic labor.

The composite input M can be either procured domestically or it can be offshored. Let $p_{M,s}$ denote the price paid by a firm with offshoring status s for a unit of composite input M, for $s \in \{n, o\}$, where n denotes "not offshoring" and o denotes "offshoring". If M is procured domestically, we are implicitly assuming that $p_{M,n}$ units of the numeraire good translate into one unit of input M. If the production of M is offshored, a firm has to pay a fixed cost of offshoring, f_o, and a variable cost, $p_{M,o}$, per unit of input M. Let p_M^* denote the price of input M in the foreign foreign country, and let $1+\lambda$ (for $\lambda > 0$) denote the iceberg cost of offshoring. It follows that

$$p_{M,o} = p_M^*(1+\lambda), \tag{A-4}$$

so that a decline in λ makes offshoring more attractive. Note that domestic firms have incentives to offshore only if $p_{M,o} < p_{M,n}$, which we assume to be the case.

Given the CES function in (A-3), the cost of unit of Y for a firm with offshoring status s is given by

$$c_s \equiv \left[\alpha^\rho + (1-\alpha)^\rho p_{M,s}^{1-\rho}\right]^{\frac{1}{1-\rho}}. \tag{A-5}$$

Thus, the marginal cost of a firm with productivity φ is $\frac{c_o}{\varphi}$ if it offshores, and is $\frac{c_n}{\varphi}$ if it does not offshore. Given $p_{M,o} < p_{M,n}$, it follows that $\frac{c_o}{\varphi} < \frac{c_n}{\varphi}$; that is, the marginal cost of a firm with productivity φ is always lower if the firm offshores.

Given the fixed cost of offshoring, f_o, there exists an offshoring cutoff productivity level, $\hat{\varphi}_o$, which divides existing firms into offshoring and non-offshoring firms: a firm offshores if and only if its productivity is no less than $\hat{\varphi}_o$. With CES preferences, the price set by a firm with productivity φ is

$$p(\varphi) = \left(\frac{\sigma}{\sigma-1}\right)\frac{c(\varphi)}{\varphi}, \tag{A-6}$$

where $c(\varphi) = c_n$ if $\varphi < \hat{\varphi}_o$, and $c(\varphi) = c_o$ if $\varphi \geq \hat{\varphi}_o$. Note that $p'(\varphi) < 0$, so that more productive firms set lower prices. Using (A-6) and (A-2), we obtain that this firm's gross profit function (before deducting fixed costs) is

$$\pi(\varphi) = \frac{p(\varphi)^{1-\sigma}P^{\sigma-\eta}\mathbb{L}}{\sigma}. \tag{A-7}$$

with $\pi'(\varphi) > 0$ (more productive firms have larger profits).

A.3 Cutoff Productivity Levels

There is a fixed cost of operation, f, in units of the numeraire. Hence, in addition to $\hat{\varphi}_o$, there is a cutoff level $\hat{\varphi}$ that determines whether or not a firm produces. A firm with productivity $\varphi < \hat{\varphi}$ does not produce because its gross profits are not large enough to cover the fixed cost of operation. Thus, $\hat{\varphi}$ is the level of productivity such that $\pi(\hat{\varphi}) = f$.

The cutoff level $\hat{\varphi}$ is only relevant if $\hat{\varphi} < \hat{\varphi}_o$ (otherwise, every producing firm offshores). We assume that $\hat{\varphi} < \hat{\varphi}_o$ is satisfied, so that the firms with productivities between $\hat{\varphi}$ and $\hat{\varphi}_o$ produce but do not offshore. Thus, we get from (A-6) that $p(\hat{\varphi}) = \left(\frac{\sigma}{\sigma-1}\right)\frac{c_n}{\hat{\varphi}}$. Substituting $p(\hat{\varphi})$ into (A-7) to obtain $\pi(\hat{\varphi})$, we write the zero-cutoff-profit condition as

$$P = \left(\frac{\sigma f}{\mathbb{L}}\right)^{\frac{1}{\sigma-\eta}}\left[\left(\frac{\sigma}{\sigma-1}\right)\frac{c_n}{\hat{\varphi}}\right]^{\frac{\sigma-1}{\sigma-\eta}}. \tag{A-8}$$

Substituting (A-6) and (A-8) into (A-7), we rewrite $\pi(\varphi)$ as

$$\pi(\varphi) = \left[\frac{\varphi}{\hat{\varphi}}\left(\frac{c_n}{c_o}\right)^{\mathbb{1}\{\varphi \geq \hat{\varphi}_o\}}\right]^{\sigma-1} f, \tag{A-9}$$

for $\varphi \geq \hat{\varphi}$, where $\mathbb{1}\{\varphi \geq \hat{\varphi}_o\}$ is an indicator function taking the value of 1 if $\varphi \geq \hat{\varphi}_o$ (and zero otherwise).

A firm with productivity $\hat{\varphi}_o$ must be indifferent between offshoring or not; that is, for this firm the net profits from offshoring and not offshoring are identical. From (A-9), this indifference condition can be written as

$$\left(\frac{\hat{\varphi}_o c_n}{\hat{\varphi} c_o}\right)^{\sigma-1} f - f - f_o = \left(\frac{\hat{\varphi}_o}{\hat{\varphi}}\right)^{\sigma-1} f - f.$$

Hence, the relationship between $\hat{\varphi}_o$ and $\hat{\varphi}$ is given by

$$\hat{\varphi}_o = B\Gamma\hat{\varphi}, \tag{A-10}$$

where

$$B = \left(\frac{f_o}{f}\right)^{\frac{1}{\sigma-1}} \quad \text{and} \quad \Gamma = \left(\frac{c_o^{\sigma-1}}{c_n^{\sigma-1} - c_o^{\sigma-1}}\right)^{\frac{1}{\sigma-1}}. \tag{A-11}$$

Note that in order for $\hat{\varphi} < \hat{\varphi}_o$, we need to satisfy $B\Gamma > 1$, which we assume to be the case.

A.4 The Free-Entry Condition and Equilibrium

Firms enter as long as the value of entry is no less than the sunk entry cost, f_E (in units of the numeraire). Given that the potential entrant knows its productivity only after entry, the pre-entry expected profit for each period is given by

$$\Pi = \int_{\hat{\varphi}}^{\hat{\varphi}_o} [\pi(\varphi) - f] g(\varphi) d\varphi + \int_{\hat{\varphi}_o}^{\infty} [\pi(\varphi) - f - f_o] g(\varphi) d\varphi. \tag{A-12}$$

At the end of every period, an exogenous death shock hits a fraction δ of the existing firms and hence, the value of entry is $\frac{\Pi}{\delta}$. The free-entry condition is then

$$\frac{\Pi}{\delta} = f_E. \tag{A-13}$$

After substituting (A-9) and (A-10) into (A-12), we can solve for the equilibrium cutoff productivity level, $\hat{\varphi}$, from equation (A-13). Under standard conditions, the equilibrium exists and is unique.[1]

A.5 Firm-Level Employment and Input Trade Costs

Differentiated-good firms face perfectly elastic supplies of domestic labor, and hence, firm-level employment is demand-determined. Let $L_s(\varphi)$ denote the demand for domestic labor of a producing firm with productivity φ and offshoring status s, for $s \in \{n, o\}$. Producing firms with status n

[1] Plugging in (A-9) and (A-10) into (A-12) and using Leibniz's rule, we obtain $\frac{d\Pi}{d\hat{\varphi}} < 0$. As Π is strictly decreasing in $\hat{\varphi}$ and it converges to zero as $\hat{\varphi}$ increases, the equilibrium exists and is unique as long as Π is greater than δf_E when $\hat{\varphi}$ approaches $\varphi_{\min}$ from the right, where $\varphi_{\min} \geq 0$ is the lower bound of the support of the productivity distribution.

have productivities in the range $[\hat{\varphi}, \hat{\varphi}_o)$, and firms with status o have productivities in the range $[\hat{\varphi}_o, \infty)$. The following lemma shows expressions for $L_n(\varphi)$ and $L_o(\varphi)$.

Lemma 1. *The demand for domestic labor of a firm with productivity $\varphi \geq \hat{\varphi}$ and offshoring status s, for $s \in \{n, o\}$, is given by*

$$L_s(\varphi) = \begin{cases} \alpha^\rho (\sigma - 1) f c_n^{\rho-1} \left(\frac{\varphi}{\hat{\varphi}}\right)^{\sigma-1} & \text{if } s = n \\ \frac{\alpha^\rho (\sigma-1) f c_n^{\sigma-1}}{c_o^{\sigma-\rho}} \left(\frac{\varphi}{\hat{\varphi}}\right)^{\sigma-1} & \text{if } s = o. \end{cases} \tag{A-14}$$

***Proof*.** Given the unit cost for Y in (A-5), Shephard's lemma implies that the requirement of L per unit of output for a firm with productivity φ and offshoring status s is given by $\alpha^\rho c_s^\rho / \varphi$, for $s \in \{n, o\}$. Therefore, $L_s(\varphi) = (\alpha^\rho c_s^\rho / \varphi)\, z(\varphi)$. Next, we use (A-2) for $z(\varphi)$ to get $L_s(\varphi) = \alpha^\rho c_s^\rho p(\varphi)^{-\sigma} P^{\sigma-\eta} \mathbb{L} / \varphi$. Lastly, substitute out $p(\varphi)$ and P using equations (A-6) and (A-8) to obtain $L_s(\varphi) = \frac{\alpha^\rho (\sigma-1) f c_n^{\sigma-1}}{c_s^{\sigma-\rho}} \left(\frac{\varphi}{\hat{\varphi}}\right)^{\sigma-1}$, for $s \in \{n, o\}$. □

A decline in λ implies a decline in the cost of offshoring composite input M. For an existing firm with productivity φ that does not change its producing or offshoring status s after a change in λ, its labor demand response is given by

$$\zeta_{L_s(\varphi), \lambda} = \begin{cases} -(\sigma - 1)\zeta_{\hat{\varphi}, \lambda} & \text{if } s = n \\ -(\sigma - 1)\zeta_{\hat{\varphi}, \lambda} + (\rho - \sigma)\zeta_{c_o, \lambda} & \text{if } s = o, \end{cases} \tag{A-15}$$

where each $\zeta_{\cdot, \lambda}$ denotes an elasticity with respect to λ. There are three effects on the demand for domestic labor when λ changes: a competition effect, a substitution effect, and a scale effect. For firms that do not change their producing or offshoring status, these three effects are respectively given by $-(\sigma - 1)\zeta_{\hat{\varphi}, \lambda}$, $\rho \zeta_{c_o, \lambda}$, and $-\sigma \zeta_{c_o, \lambda}$ in (A-15). The following lemma shows expressions for the elasticities on the right-hand side of equation (A-15), along with other useful results.

Lemma 2. *The elasticities of c_o, $\hat{\varphi}$, Γ, and $\hat{\varphi}_o$ with respect to λ are given by*

i) $\zeta_{c_o, \lambda} = \left(1 - \alpha^\rho c_o^{\rho-1}\right) \lambda / (1 + \lambda) \in (0, \lambda / (1 + \lambda))$,

ii) $\zeta_{\hat{\varphi}, \lambda} = -\mu_o \zeta_{c_o, \lambda} \in (-\zeta_{c_o, \lambda}, 0)$ *because* $\mu_o \in (0, 1)$,

iii) $\zeta_{\Gamma, \lambda} = \left(1 + \Gamma^{\sigma-1}\right) \zeta_{c_o, \lambda} > \zeta_{c_o, \lambda}$,

iv) $\zeta_{\hat{\varphi}_o, \lambda} = \zeta_{\Gamma, \lambda} + \zeta_{\hat{\varphi}, \lambda} > 0$.

***Proof*.** Since $c_o \equiv \left[\alpha^\rho + (1 - \alpha)^\rho \left(p_{M,o}\right)^{1-\rho}\right]^{\frac{1}{1-\rho}}$, we get

$$\zeta_{c_o, \lambda} = \left(\frac{\lambda}{1 + \lambda}\right) \left[\frac{(1 - \alpha)^\rho p_{M,o}^{1-\rho}}{\alpha^\rho + (1 - \alpha)^\rho p_{M,o}^{1-\rho}}\right] = \left(\frac{\lambda}{1 + \lambda}\right) \left(1 - \alpha^\rho c_o^{\rho-1}\right) \in \left(0, \frac{\lambda}{1 + \lambda}\right). \tag{A-16}$$

In (A-16) we use the result that $\zeta_{p_{M,o},\lambda} = \lambda/(1+\lambda)$ because $p_{M,o} = p_M^*(1+\lambda)$, and p_M^* is constant.

For $\zeta_{\Gamma,\lambda}$, we use the expression for Γ in (A-11) to get

$$\zeta_{\Gamma,\lambda} = \frac{d\ln\Gamma}{d\ln\lambda} = \left(1 + \frac{c_o^{\sigma-1}}{c_n^{\sigma-1} - c_o^{\sigma-1}}\right)\zeta_{c_o,\lambda} = \left(1+\Gamma^{\sigma-1}\right)\zeta_{c_o,\lambda} > \zeta_{c_o,\lambda}. \tag{A-17}$$

For $\zeta_{\hat{\varphi}_o,\lambda}$, it follows from (A-10) that

$$\zeta_{\hat{\varphi}_o,\lambda} = \zeta_{\Gamma(\hat{\alpha}),\lambda} + \zeta_{\hat{\varphi},\lambda}. \tag{A-18}$$

To obtain $\zeta_{\hat{\varphi},\lambda}$, note that given the free entry condition in (A-13), it must be true that $\frac{d\Pi}{d\lambda} = 0$. Using equation (A-9) to rewrite Π as

$$\Pi = \int_{\hat{\varphi}}^{\hat{\varphi}_o}\left(\frac{\varphi}{\hat{\varphi}}\right)^{\sigma-1} fg(\varphi)d\varphi + \int_{\hat{\varphi}_o}^{\infty}\left(\frac{\varphi c_n}{\hat{\varphi}c_o}\right)^{\sigma-1} fg(\varphi)d\varphi - f(1-G(\hat{\varphi})) - f_o(1-G(\hat{\varphi}_o)), \tag{A-19}$$

we apply Leibiniz's rule along with $B^{\sigma-1} = \frac{f_o}{f}$, and equations (A-10) and (A-18) to obtain that $\frac{d\Pi}{d\lambda} = 0$ is equivalent to

$$\zeta_{\hat{\varphi},\lambda}\left[\int_{\hat{\varphi}}^{\hat{\varphi}_o}\varphi^{\sigma-1}g(\varphi)d\varphi + \int_{\hat{\varphi}_o}^{\infty}\left(\frac{\varphi c_n}{c_o}\right)^{\sigma-1} g(\varphi)d\varphi\right] + \zeta_{c_o,\lambda}\int_{\hat{\varphi}_o}^{\infty}\left(\frac{\varphi c_n}{c_o}\right)^{\sigma-1} g(\varphi)d\varphi = 0.$$

It follows that

$$\zeta_{\hat{\varphi},\lambda} = -\mu_o\zeta_{c_o,\lambda}, \tag{A-20}$$

where

$$\mu_o = \left[\int_{\hat{\varphi}_o}^{\infty}\left(\frac{\varphi c_n}{c_o}\right)^{\sigma-1} g(\varphi)d\varphi\right] \Big/ \left[\int_{\hat{\varphi}}^{\hat{\varphi}_o}\varphi^{\sigma-1}g(\varphi)d\varphi + \int_{\hat{\varphi}_o}^{\infty}\left(\frac{\varphi c_n}{c_o}\right)^{\sigma-1} g(\varphi)d\varphi\right] \in (0,1).$$

Thus, $\zeta_{\hat{\varphi},\lambda} \in (-\zeta_{c(\hat{\alpha}),\lambda}, 0)$. This result and equations (A-17) and (A-18) imply that $\zeta_{\hat{\varphi}_o,\lambda} > 0$. $\square$

The discussion of the three effects is in section 2.2. After the decline in λ, the firms between the old and new $\hat{\varphi}$ die, and the firms between the new and old $\hat{\varphi}_o$ start to offshore. For the latter firms, their labor demand changes from $L_n(\varphi)$ to $L_o(\varphi)$.

A.6 Preferences with Many Differentiated-Good Sectors

As mentioned in section 2.3, the model can be easily extended to include several differentiated-good sectors. The preferences of the representative household are now given by

$$\mathbb{U} = H + \frac{\eta}{\eta-1}\sum_{j=1}^{J} Z_j^{\frac{\eta-1}{\eta}},$$

where H denotes consumption of the homogeneous good, Z_j is the CES composite of differentiated goods from industry j, and J is the number of differentiated-good sectors. As described in equation (12), each industry composite is also used as input by non-offshoring firms in all industries.

B Stylized Facts on Job Flows

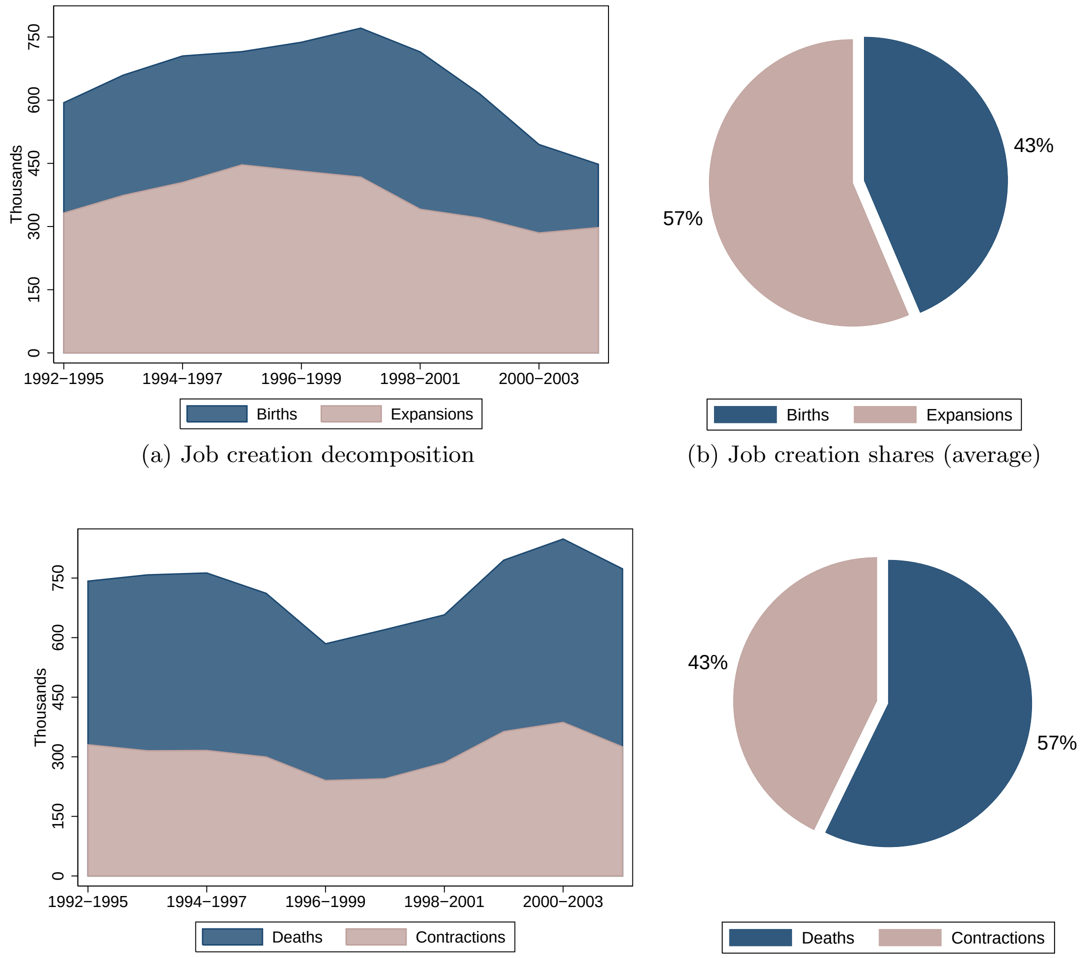
This section presents some stylized facts about the evolution of job flows in our data. Table B.1 shows the decomposition of job flows in California's manufacturing industry in three-year windows. As in the work of Davis and Haltiwanger (1992), we obtain that the net employment changes conceal substantial gross job flows on both the intensive and extensive margins of employment. Figures B.1 and B.2 summarize these results.

Table B.1: Job Flows Decomposition in California's Manufacturing Industry

	1992-1995	**1993-1996**	**1994-1997**	**1995-1998**	**1996-1999**
Employment at initial year	3,154,004	3,042,614	3,045,497	3,005,669	2,943,955
Employment at final year	3,005,669	2,943,955	2,987,589	3,009,322	3,096,931
Change in employment					
Due to expansions	331,996	373,782	404,602	446,388	431,332
Due to contractions	-330,212	-315,076	-315,817	-299,356	-240,156
Due to births	261,941	285,588	300,333	268,853	306,224
Due to deaths	-412,060	-442,953	-447,026	-412,232	-344,424
Net changes					
Expansions-Contractions	1,784	58,706	88,785	147,032	191,176
Births-Deaths	-150,119	-157,365	-146,693	-143,379	-38,200
Net employment creation	-148,335	-98,659	-57,908	3,653	152,976

	1997-2000	**1998-2001**	**1999-2002**	**2000-2003**	**2001-2004**
Employment at initial year	2,987,589	3,009,322	3,096,931	3,138,357	3,066,571
Employment at final year	3,138,357	3,066,571	2,917,241	2,784,782	2,741,185
Change in employment					
Due to expansions	417,172	341,024	320,243	284,628	297,535
Due to contractions	-244,535	-284,767	-363,408	-386,536	-324,939
Due to births	353,832	373,596	295,118	210,197	150,339
Due to deaths	-375,701	-372,604	-431,643	-461,864	-448,321
Net changes					
Expansions-Contractions	172,637	56,257	-43,165	-101,908	-27,404
Births-Deaths	-21,869	992	-136,525	-251,667	-297,982
Net employment creation	150,768	57,249	-179,690	-353,575	-325,386

Figure B.1a presents the sources of job creation. We observe that job creation reached its peak in the period 1997-2000 and then started a sharp decline, driven mostly by the decrease in establishment births. Moreover, Figure B.1b shows that expansions of existing establishments were the principal source of job creation from 1992 to 2004, with an average share of 57%. On the other hand, Figure B.1c shows that job destruction declined towards the second half of the 1990s and



(a) Job creation decomposition

(b) Job creation shares (average)

(c) Job destruction decomposition

(d) Job destruction shares (average)

Figure B.1: Employment creation and destruction in California's manufacturing industry (three-year windows)

then increased substantially during the 2000s. In Figure B.1d we obtain that on average 57% of job destruction is accounted for by the death of firms. Therefore, a first stylized fact about job flows in the manufacturing industry is that from 1992 to 2004, the intensive margin of employment dominates in job creation, while the extensive margin dominates in job destruction.

Lastly, Figure B.2 shows net employment changes at the intensive and extensive margins, and overall. Note first that the net effect at the intensive margin of employment (job creation by expansions minus job destruction by contractions) was positive up to the period 1998-2001 and became negative since then. On the other hand, the net effect at the extensive margin of employment (job creation by births minus job destruction by deaths) was negative with the exception of the period 1998-2001 when it was positive but very close to zero. With respect to overall net employment changes, we observe that the period of net job creation in the last part of the 1990s was driven by

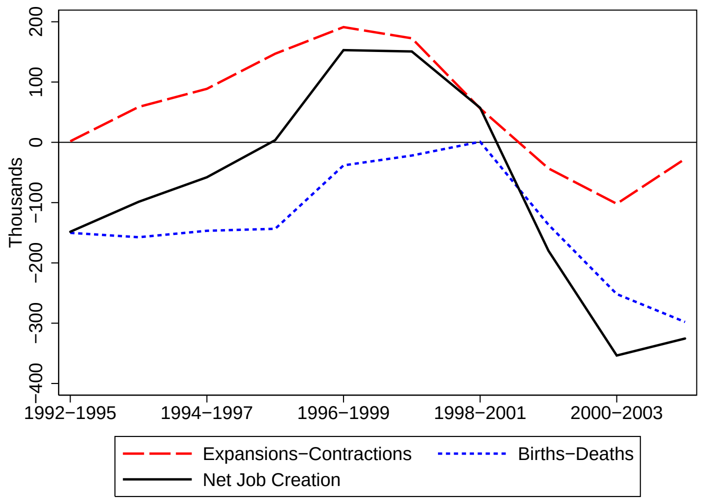


Figure B.2: Net employment creation in California's manufacturing industry

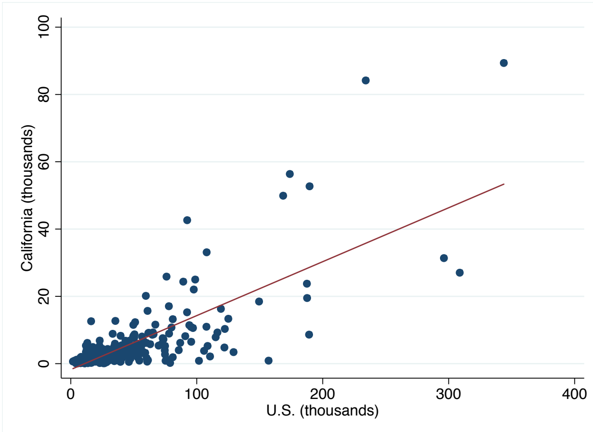
the intensive margin, while the periods of net job destruction were dominated by the extensive margin. Hence, we can write our second and third stylized facts about job flows in the manufacturing industry. The second stylized fact is that the period of net job creation during the *dot-com bubble* was driven by the intensive margin of employment. From Table B.1, note that the intensive margin improvements over that period were driven evenly by increases in job creation by expansions and decreases in job destruction by contractions. The third stylized fact is that the most important period of net job destruction in the history of the manufacturing industry (at the beginning of the 2000s) was driven mostly by the extensive margin of employment. As seen in Table B.1, the worsening of the extensive margin over that period was the result of reinforcing changes in job destruction by death and job creation by birth.

C Supporting Material for the Empirical Exercise

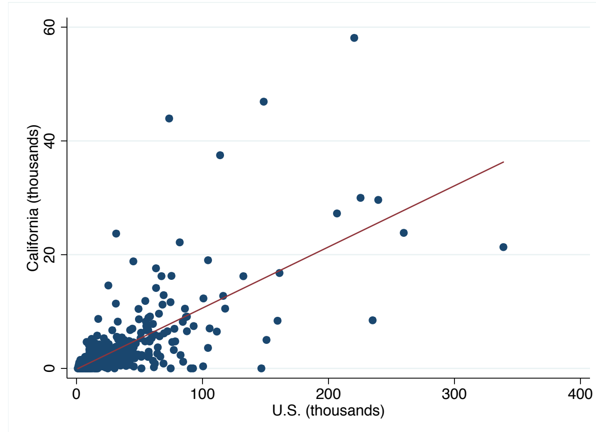
This section presents further support for the high correlation between manufacturing employment in California and in the U.S., and a fifth robustness check for our estimation.

C.1 Manufacturing Employment at the Six-Digit NAICS Level

In section 3.1.1 we showed that manufacturing employment in California and in the entire country are highly correlated. Using QCEW data at the three-digit NAICS level, which includes 21 manufacturing industries, the correlations are 0.82 for 1992 and 0.74 for 2003. Moreover, if we remove industry 334 (Computer and Electronic Product Manufacturing)—which is heavily located in California (accounting for about 25% of the industry's national employment)—the correlations are 0.94 in 1992 and 0.89 in 2004. Figure C.1 shows that the correlations remain very high even



(a) 1992



(b) 2004

Figure C.1: Manufacturing employment at six-digit NAICS level: California versus the U.S.

at the six-digit NAICS level, which includes 409 manufacturing industries (in terms of industry classification, the six-digit NAICS level is the equivalent to the four-digit SIC level we used in our estimation). The correlation levels are 0.76 in 1992 and 0.72 in 2004.

C.2 Fifth Robustness Check: Using Tariffs and Freight Separately

In section 3.2 we compute each industry's final-good trade cost as the sum of the industry's average tariff rate and the industry's average international freight rate. As in Bernard, Jensen, and Schott (2006), the objective of this approach is to get as close as possible to the iceberg trade cost assumed in heterogeneous-firm models. Nevertheless, it is important to verify that each of these components (tariffs and freight) affect firm-level employment in the expected direction. Also, we can obtain valuable information on whether one of this components is more relevant than the other for firm-level decisions. Therefore, in this robustness check we consider tariffs and freight separately.

First we estimate the specifications in (17), (18), (19), and (22) by including both tariffs and freight. Table C.1 presents the results. Again, we compare these results against those in columns (2), (4), and (6) in Table 2, and column (2) in Table 4. All the coefficients have the same signs as in the benchmark regressions.

For the coefficient on tariffs, the only difference with respect to the benchmark results is in the coefficients for the job-contractions regression, which yield a higher importance for final-good trade costs. However, the net intensive margin results continue to hold (the coefficients are larger in magnitude, though they are less efficient). The death-likelihood regression yields coefficients on tariffs that are larger in magnitude than the benchmark coefficients (about twice as large), and continue to be statistically significant at a 1% level.

Table C.1: Tariffs and Freight

Dependent variable (at time t) indicated in columns				
Regressor (at t–1)	**Job expansions (e)**	**Job contractions (c)**	**Net intensive margin ($\dot{E} \equiv e$–c)**	**Death likelihood (d)**
△(Input *tariff*)	1.902**	-0.519	2.421*	-2.078***
	(0.848)	(0.600)	(1.298)	(0.786)
× (Relative Productivity)	-1.897**	0.545	-2.442**	1.867***
	(0.767)	(0.547)	(1.179)	(0.647)
△(Final-good *tariff*)	0.391	-0.725***	1.116*	-1.391***
	(0.426)	(0.259)	(0.618)	(0.344)
× (Relative Productivity)	-0.235	0.505**	-0.740	0.816***
	(0.424)	(0.243)	(0.607)	(0.256)
△(Input *freight*)	1.097**	-0.712***	1.809***	-0.227
	(0.507)	(0.242)	(0.693)	(0.405)
× (Relative Productivity)	-0.955**	0.710***	-1.665***	0.362
	(0.401)	(0.216)	(0.561)	(0.284)
△(Final-good *freight*)	0.763***	-0.021	0.784**	-0.368*
	(0.178)	(0.166)	(0.308)	(0.207)
× (Relative Productivity)	-0.605***	0.125	-0.730***	0.092
	(0.169)	(0.115)	(0.244)	(0.140)
Industry-level controls	Yes	Yes	Yes	Yes
Observations	219,593	219,593	219,593	276,367
Establishments	88,606	88,606	88,606	

Notes: All regressions include industry-time fixed effects (defined at the two-digit SIC level), and the establishment's log age. The first three columns include establishment-level fixed effects. The fourth column shows the linear probability model. Industry-level controls (at four-digit SIC level) are the lagged log difference of: the price and value of shipments, the price of materials, total factor productivity, and the industry's employment level. Robust standard errors (in parentheses) clustered at the four-digit SIC industry level. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

For the freight coefficients, the three intensive-margin regressions (expansions, contractions, and net) yield results that are similar in magnitude and significance to the benchmark results. In contrast, the coefficients for the death-likelihood regression are smaller and only one of them is statistically significant (at a 10% level).

To sum up, the net intensive margin results when we split our trade cost measure into its tariffs and freight components are similar to the benchmark results. On the other hand, the death-likelihood regression indicates that tariffs are far more important than freight costs as a determinant of establishments' exit decisions. For completeness, Tables C.2 and C.3 estimate the models including either only the tariff measure or only the freight measure. The results are very similar to those in Table C.1.

Table C.2: Tariffs

Dependent variable (at time t) indicated in columns				
Regressor (at t–1)	**Job expansions (e)**	**Job contractions (c)**	**Net intensive margin ($\dot{E} \equiv e$–c)**	**Death likelihood (d)**
△(Input tariff)	1.630*	-0.421	2.051	-2.036***
	(0.899)	(0.609)	(1.365)	(0.783)
× (Relative Productivity)	-1.665**	0.444	-2.110*	1.873***
	(0.816)	(0.562)	(1.244)	(0.648)
△(Final-good tariff)	0.596	-0.793***	1.389**	-1.469***
	(0.427)	(0.264)	(0.625)	(0.343)
× (Relative Productivity)	-0.405	0.573**	-0.978	0.849***
	(0.420)	(0.248)	(0.607)	(0.255)
Industry-level controls	Yes	Yes	Yes	Yes
Observations	219,593	219,593	219,593	276,367
Establishments	88,606	88,606	88,606	

Notes: All regressions include industry-time fixed effects (defined at the two-digit SIC level), and the establishment's log age. The first three columns include establishment-level fixed effects. The fourth column shows the linear probability model. Industry-level controls (at four-digit SIC level) are the lagged log difference of: the price and value of shipments, the price of materials, total factor productivity, and the industry's employment level. Robust standard errors (in parentheses) clustered at the four-digit SIC industry level. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

Table C.3: Freight

Dependent variable (at time t) indicated in columns				
Regressor (at t–1)	**Job expansions (e)**	**Job contractions (c)**	**Net intensive margin ($\dot{E} \equiv e$–c)**	**Death likelihood (d)**
△(Input freight)	1.069**	-0.721***	1.791**	-0.360
	(0.528)	(0.249)	(0.723)	(0.359)
× (Relative Productivity)	-0.932**	0.718***	-1.650***	0.496*
	(0.416)	(0.221)	(0.583)	(0.273)
△(Final-good freight)	0.765***	-0.042	0.807***	-0.455**
	(0.178)	(0.167)	(0.309)	(0.183)
× (Relative Productivity)	-0.603***	0.141	-0.744***	0.161
	(0.168)	(0.116)	(0.243)	(0.121)
Industry-level controls	Yes	Yes	Yes	Yes
Observations	219,593	219,593	219,593	276,367
Establishments	88,606	88,606	88,606	

Notes: All regressions include industry-time fixed effects (defined at the two-digit SIC level), and the establishment's log age. The first three columns include establishment-level fixed effects. The fourth column shows the linear probability model. Industry-level controls (at four-digit SIC level) are the lagged log difference of: the price and value of shipments, the price of materials, total factor productivity, and the industry's employment level. Robust standard errors (in parentheses) clustered at the four-digit SIC industry level. The coefficients are statistically significant at the *10%, **5%, or ***1% level.

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