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Productivity Dynamics in the Distributive Trade Sector of Brazil, 1996-2004 *

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ABSTRACT

This paper studies the productivity performance of distributive trade firms in Brazil. We decompose productivity growth within distributive trade industries into the contribution from entering, exiting, and continuing firms during 1996-2004. The decomposition indicates that productivity growth in the distributive trade sector of Brazil is largely due to productivity growth within continuing firms. Reallocation effects are small despite liberalization of services markets. Our findings of the distributive trade sector in Brazil are different from that in several OECD countries (in particular the UK and the US), where reallocation dynamics play an important role in accounting for growth.

Keywords: Distributive Trade Sector, Decomposition Analysis, Brazil.

JEL Classification: L81, O12, O47.

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RESUMEN

El presente artículo estudia el comportamiento de la productividad de las firmas pertenecientes al sector de comercio mayorista y minorista en Brasil. El crecimiento de la productividad en el sector es descompuesto en las contribuciones derivadas de la entrada, salida y permanencia de las empresas entre 1996-2004. La descomposición indica que el crecimiento de productividad del sector se debe en gran parte a las empresas que han permanecido en el mercado. Los efectos de la reasignación son pequeños a pesar de la liberalización del mercado de servicios. Los resultados obtenidos en Brasil difieren de varios países de la OCDE (en particular el Reino Unido y Estados Unidos), donde la dinámica de reasignación juega un importante rol en la contabilidad del crecimiento.

Keywords: Comercio Mayorista y Minorista, Análisis de Descomposición, Brasil.

Clasificación JEL: L81, O12, O47.

I. INTRODUCTION

The distributive trade sector accounts for a large share of the Brazilian economy, both in terms of employment and value added (de Melo et al., 1998). It faced several political and technological changes during the 1990s, including the Real plan (1994), services liberalization commitments, and the rapid emergence of information and communication technology (ICT). It is supposed to raise productivity growth of the total economy as it did in OECD countries (Inklaar et al., 2008). But despite its share in the Brazilian economy and its changing economic environment, little attention is paid to its productivity performance. Indeed, sparse evidence on the productivity of the distributive trade sectors suggests that is below average productivity of the total economy during the 1990s (de Melo et al., 1998).

In this paper, we aim to contribute to the knowledge about the structure and firm level productivity dynamics of Brazil's wholesale and retail trade sector. We decompose productivity growth within distributive trade industries into the contribution from entering, exiting, and continuing firms during 1996-2004. The decomposition analysis sheds light on the relative contribution to growth from within-firm productivity change, between-firm market shares change (reallocation of resources to higher productivity firms), and the entry and exit of firms. We relate our findings to the main political and technological changes during the 1990s.

The literature offers two theoretical models to interpret aggregate productivity growth (Foster et al., 2002).[1]

First, growth may be driven by idiosyncratic shocks at the firm level, which cancel out in the aggregate as in standard neoclassical growth models. In these models, productivity growth can be modeled and studied by examining changes averaged across firms. Second, growth may be the result of creative destruction if the introduction of new production processes and new products is a process involving much trial and error. In these models, growth is connected to the reallocation of production inputs and outputs (Aghion and Howitt, 1994). And this reallocation is the result of firm entry and exit, and/or reallocation dynamics among continuing firms. Decompositions of aggregate productivity growth speak to one of these two growth models. Neoclassical growth models imply large within-firm effects, whereas models of growth through creative destruction are related with between-firm market share changes and net-entry effects.

Studies of the distributive trade sector in OECD countries suggest that reallocation dynamics play an important role in accounting for aggregate productivity growth. Foster et al. (2006) examine the US retail trade sector. They use establishment level census data for the years 1987, 1992, and 1997. During the 1987 to 1997 period they find that most productivity growth is accounted for by the entry of new establishments. In particular, new establishments from continuing firms contribute to growth.[2]

Haskel and Sadun (2007) study the UK trade sector. They argue that productivity growth in the UK retail trade sector is below that of the US because of regulation concerning the maximum store size. As a result of planning regulation, retail chains in the UK open smaller stores. In the

1. Other models, such as the passive and active firm learning models by Jovanovic (1982) and Ericson and Pakes (1995) offer an explanation for firm dynamics and heterogeneity in firm productivity within narrowly defined sectors.

2. In this paper, we examine firm dynamics using firm-level data. Most studies examine firm dynamics this way (Bartelsman and Doms, 2000; Bartelsman et al., 2005). But some studies examine firm dynamics at the establishment level (Foster et al., 2006; Matsuura and Motohashi, 2005). The difference between the two concepts is that firm-level analysis does not distinguish between single-establishment firms and firms with multiple outlets whereas an establishment-level analysis does. Therefore an establishment-level analysis is able to decompose movements in productivity into changes within establishments on the one hand and changes within firms on the other. The unit of analysis should be kept in mind when comparing decomposition results in this paper with other studies. For example, new establishments from continuing firms are (largely) included in between-firm effects in our paper, whereas it is counted as an entering establishment from a continuing firm in Foster et al. (2006) and examined as such.

presence of economies of scale at the store level, smaller stores are associated with lower productivity growth in the UK as compared to the US. Matsuura and Motohashi (2005) study market dynamics in the trade sector of Japan. They decompose productivity growth during the 1997 to 2002 period and find that most growth is accounted for by the reallocation of market share to higher productivity trade firms (that is, between-firm productivity change). Within-firm productivity change is negative and the net-entry effect on growth is small in Japan's trade sector. Thus, findings from these studies suggest that a model of growth through creative destruction underlies aggregate productivity growth in the distributive trade sector of OECD countries.

In contrast, we find that reallocation dynamics play a modest role relative to within firm productivity growth in the distributive trade sector of Brazil. We find little evidence that retailing chains are replacing low productivity mom and pop stores, a process that has been under way for some time in several OECD countries (in particular the UK and the US) and explains most productivity growth in these countries (Foster et al., 2006; Haskel and Sadun, 2007). Our findings for Brazil therefore correspond closer to standard neoclassical growth models. The (scale related) adoption of Information and Communication Technologies (ICT), and the shift from financial to operations management and the increased demand for higher margin goods after the introduction of the Real plan might be related with within firm productivity improvements. We find a positive relation between foreign direct investment (FDI) and within firm productivity changes, and between FDI and reallocation dynamics across the Federal states of Brazil. But the latter relation is modest and insignificant, which underpins the argument that reallocation effects are modest despite the liberalization of services markets during the 1990s.

The remainder of this paper is structured as follows. In section 2 we describe the main political and technological changes which distributive trade firms faced during the period we analyse. In section 3 we give a detailed description of distributive trade firms in Brazil. We describe the decomposition method in section 4. Decomposition results are presented in section 5. Conclusions are presented in section 6.

II. POLITICAL AND TECHNOLOGICAL CHANGES DURING THE 1990S

In this section we discuss political and technological changes which are likely to be important for understanding the development of the trade sector in Brazil.

II.1 Political changes

Numerous policy changes affected the behaviour and performance of distributive trade firms, but two policy changes stand out in the 1990s. First, the introduction of the Real plan in 1994. The Real plan brought an end to running inflation (the average annual inflation rate between January 1986 and December 1994 was 820 percent). The Real plan had two main components: fiscal adjustment, and an indexing system that gradually led to a new currency (Baer, 2008). Fiscal adjustment entailed a general tax increase of 5 percent, the creation of a social emergency fund to temporarily adjust fiscal imbalances, and spending cuts on government investments, personnel and state companies. The indexing system consisted of an indexer, the Unit of Real Value (URV), which was tied to the dollar. The URV gradually came to replace the Cruzeiro. The Cruzeiro was eventually replaced by the Real on July 1st 1994. The Real plan successfully ended hyperinflation in Brazil. Consumer purchasing power increased when hyperinflation ended (World Bank, 2004).[3]

The increase in purchasing power stimulated demand for goods with a higher margin (Mulder, 1999).[4] And this increased demand for higher margin goods should be reflected in higher sales volumes and gross margins. Thus, productivity measures based on sales or gross margins will be positively affected in the initial years following the introduction of the Real plan.[5] Furthermore, during hyperinflation operations management was secondary to financial management (McKinsey, 1998). Retailers existed from profits on negative working capital because most of their sales were paid for on the spot while they enjoyed high interest rates for up to 60 days before payment to their suppliers.[6] Attention shifted to operation management when hyperinflation ended. We expect this shift in attention led to firm performance improvements.

The second major policy change is services liberalization since the early 1990s. The Collor administration, which came to power in March

3. Consumer spending fell by 23 percent during 1988 to 1992, and became largely oriented toward food purchases (Euromonitor, 1995).

4. In 1994, retail sales increased by 14 percent (BNDES, 1996).

5. Costs of goods sold are subtracted from gross margins to arrive at value added. Thus a productivity measure based on value added is unaffected by increased demand for higher-margin goods (Inklaar and Timmer, 2008).

6. In addition, some evidence suggests that retailers raised prices faster than inflation during the period of hyperinflation, which increased profit margins (Euromonitor, 1995)

1990, began a process of privatization, deregulation, and greater openness to foreign trade. This process was continued by subsequent governments throughout the 1990s. For trade in goods, a gradual reduction of tariffs was initiated and the exchange rate was allowed to fluctuate (Baer, 2008). For trade in services, policy reforms were visible in liberalization commitments in the WTO's General Agreement on Trade in Services (GATS), but also within MERCOSUR,[7] and between the MERCOSUR members and the European Union (World Bank, 2004). The GATS agreement, the most encompassing liberalization commitment, was signed by Brazil in January 1995. For Brazil, this agreement encompassed all but a few services industries. And while policy reforms varied considerably across industries, a few common trends applied to all. One common trend was the participation of foreign capital in Brazilian firms, which was freed from restrictions for most services industries in the Sixth Constitutional Amendment of 1995. Another common trend was the removal of discriminatory treatment of Brazilian services firms on foreign or domestic ownership and control (World Bank, 2004).

In most distributive trade industries, foreign firms no longer faced restrictions after 1995. Under the GATS agreement, Brazil committed itself to unrestricted commercial presence of foreign distributive trade firms in wholesale trade, except for wholesaling of solid, liquid and gaseous fuels and related products. Brazil's commitment for retail trade included both food and nonfood retailing, except for retailing of motor vehicles, motorcycles, or related parts and accessories. Franchising services were left unbound, which means that regulatory measures for franchising are not stated and may be imposed (USICT, 1996). Despite the GATS agreement, several protective policies still existed in the 1990s. First, subsidies for research and development, a potential channel for subsidizing domestic firms, were left unbound for all modes of supply. Second, sole proprietorship or partnership as a juridical person for foreign firms was not recognized by Brazilian law. This implies that foreign firms can only establish commercial presence in the form of a subsidiary or a joint venture. Third, the temporary entry and stay of technicians, professionals, and managers remained restricted (USICT, 1996).

Due to services liberalization and the successful introduction of the Real plan, the Brazilian distributive trade sector became more attractive

7. The regional trade block consisting of Argentina, Brazil, Paraguay, and Uruguay.

to foreign firms during the 1990s. Because retail trade requires the direct interaction between producers and consumers, it is of some interest to examine changes in foreign direct investment (FDI) in the mid 1990s. In table 1, the FDI stock by economic activity is shown. The last row in table 1 shows that FDI increased substantially during 1995 to 2000. Interestingly, the historical pattern of FDI inflows altered in the 1990s.

Table 1

Sectoral composition of FDI stock

SECTOR	1995		2000	
	stock	share (in percentages)	stock	share (in percentages)
Agriculture and mining	925	2.2	2,401	2.3
Industry	27,907	66.9	34,726	33.7
Services	12,864	30.9	65,888	64
of which:				
Public Utilities	2	0.5	7,262	7
Construction	203	0.5	416	0.4
Repair services	84	0.2	429	0.4
Distribution services	2,801	6.7	9,811	9.5
of which:				
Wholesale trade	2,132	5.1	5,918	5.7
Retail trade	669	1.6	3,893	3.8
Hotels and restaurants	364	0.9	317	0.3
Transport and communication	592	1.4	19,257	18.7
Financial services	3,288	7.9	13,45	13.1
Other services	5,529	13.3	14,947	14.5
Total	41,696	100	103,015	100

Source: Censo de Capitais Estrangeiros 1995 e 2000 (BACEN/DECEC), Banco Central do Brasil. Notes: In millions of current US dollars. Other services include business services.

In 1995, two third of the foreign capital stock was located in manufacturing, whereas the remaining one third was invested in services.

In 2000, the sectoral composition of the foreign capital stock was exactly the opposite of that in 1995. In 2000, two third of foreign capital was build up in services industries, whereas the remaining one third was in manufacturing industries. Detailed FDI data for distributive trade services are shown in table 1 as well. The FDI stock of wholesale trade increased threefold, and that of retail trade increased sixfold from 1995 to 2000. FDI growth in wholesale and retail trade services was above average FDI growth. A strong increase in foreign participation in Brazil's trade sector is consistent with the analysis by Concha-Amin and Dias de Aguiar (2006) of international supermarket chains.[8] WalMart entered the market in 1995 through a majority interest in a joint venture with Lojas Americanas. But also Sonae (since 1989), Royal Ahold (since 1996), Casino (since 1999), and Jeronimo Martins (since 1997) entered or expanded their market share through mergers and acquisitions in the late 1990s. Concha-Amin and Dias de Aguiar (2006) analyse the period from 1989 to 2002 and conclude that during this period, 93 percent of all mergers and acquisitions by foreign firms took place after 1997. Indeed, 70 percent of the mergers took place in just three years (1999, 2000, and 2001).

In table 2, the total FDI stock by Federal state for 1995 and 2000 is shown.[9] Evidently, there is much dispersion in the location of foreign firms. Most foreign firms operate in the South East (Minas Gerais, Sao Paulo, and Rio de Janeiro) or in the South (Rio Grande do Sul). These regions also command the majority of economic activity in Brazil and have the highest income per capita (Baer, 2008). The entry and market expansion of international trade firms might be related with increased competition. In particular, we expect higher competition and therefore a better allocation of resources in Federal states which received more FDI investment. This should be reflected in higher reallocation dynamics in these states. Alternatively, the increasing presence of foreign trade firms might lead to productivity improvements within firms facing tougher competition. We test these hypotheses in section 5.

II.2 Technological changes

The crucial importance of information and communication technology to conduct business and to streamline operations is virtually

8. Foreign companies also entered in non-food retailing industries, for example apparel (J.C. Penney), book stores (Fnac), and building materials (Leroy Martin, Castorama) (Santos and Gimenez, 1999).

9. Publicly available data does not allow us to distinguish the foreign capital stock in distributive trade services from the total FDI stock across regions.

Table 2
FDI Stock by region

	Acre	Alagoas	Amazonas	Amapá	Bahia	Ceará	Distrito Federal	Espírito Santo	Goiás
UF	12	27	13	16	29	23	53	32	52
1995	1,397	192,67	258,9	7,968	645,646	142,262	44,802	603,342	47,288
2000	7,602	75,854	876,234	2,316	821,302	558,327	516,368	657,12	540,486

	Maranhao	Minas Gerais	Mato Grosso do Sul	Mato Grosso	Pará	Paraíba	Pernambuco	Piauí	Paraná
UF	21	31	50	51	15	25	26	22	41
1995	553,999	2,684,247	15,023	110,837	570,666	18,186	44,627	5,009	923,576
2000	745,825	4,350,165	44,997	201,835	621,873	110,631	800,767	10,165	2,807,209

	Rio de Janeiro	Rio Grande do Norte	Rondónia	Roraima	Rio Grande do Sul	Santa Catarina	Sergipe	Sao Paulo	Tocantins
UF	33	24	11	14	43	42	28	35	17
1995	5,695,920	12,318	1,479	0	1,065,683	294,587	3,762	27,699,344	303
2000	16,302,963	15,905	56,85	5,969	4,122,442	598,904	48,269	68,011,364	620

Source: Censo de Capitais Estrangeiros 1995 e 2000 (BACEN/DECEC), Banco Central do Brasil. Notes: in millions of current US dollars. UF is Unidade Federal, code of respective state.

unequivocally accepted (OECD, 2003). Benefits from the use of ICT hold in particular for wholesale and retail trade firms (McKinsey, 2001; Santos and Gimenez, 1999). Investment in ICT can improve firm performance directly. For example, bar codes and scanners reduce checkout time and eliminate the need to manually price tag products thereby reducing labour costs. In addition, trade firms can use computers for administration, inventory control, storage optimization, and pricing and promotion of products (McKinsey, 2001). Such ICT effects on firm performance may require substantial organizational changes. But they potentially yield sustained improvements due to an improved matching of inventory to customer demand, more responsive price changes, more efficient use of shelf space, reduced inventory and fewer out-of-stock situations, the potential to evaluate and optimize advertising campaigns, and more efficient use of trucking and shipping (McGuckin et al., 2005).

Despite ICT's potential to raise productivity, trade firms in Brazil have not been quick to adopt ICT (McKinsey, 1998). Brazil was virtually closed to foreign hardware and software until 1992 (Luzio and Greenstein, 1995) and hyperinflation during the mid 1980s until 1994 distorted relative factor prices. ICT investment prices were high relative to labour costs, inducing firms to hire extra workers instead of automating processes. When hyperinflation ended and the market for ICT goods and services was liberalized, trade firms started to adopt ICT although investment levels (and quality) lag behind advanced OECD countries (McKinsey, 1998; ECLAC, 2008).

The adoption of ICT by trade firms can result in intra-firm productivity change. Several studies find that ICT investment improves the productivity of trade firms (Reardon et al., 1996; Broersma et al., 2003; Doms et al., 2004). In particular, large trade firms adopt ICT and productivity impacts are largest for these firms, which suggests that ICT technology is related with scale (Doms et al., 2004). We do not have information on ICT investments by firms, but instead we examine scale related productivity changes in section 5, after presenting the data set and decomposition method.

III. DISTRIBUTIVE TRADE FIRMS IN BRAZIL

In Brazil, distributive trade firms show a large variety in scale, ranging from small informal shop keepers to large exporting firms. The Pesquisa Anual de Comércio (PAC), the annual survey of distributive trade firms, estimates that 1.38 million trade firms, with some 1.44 million

establishments are active in Brazil in 2004 (IBGE, 2004). For that year, distributive trade firms employ around 6.68 million workers and account for a substantial share of total employment in Brazil.[10]

An important distinction of trade firms is between retail trade and wholesale trade. Retail trade firms (ISIC rev. 3, industry 52) sell goods, manufactured elsewhere, to individuals or households. The retail industry is characterized by a large number of small sized establishments. Approximately 1.16 million retail firms with 1.21 million establishments are active in 2004, and sales by these firms represent 41.8 percent of the total, whereas the employment share is about 76.1 percent. Wholesale trade firms (ISIC rev. 3, industry 51) sell goods, not manufactured by themselves, to retailers and other large scale buyers. Wholesalers are characterized by high sales volumes, with smaller gross profits. In 2004, 98,109 wholesale trade firms have a sales share of 45.8 percent and an employment share of 14.8 percent in the trade sector of Brazil. Finally a third group, firms which sell cars, car parts, and motorcycles and equipment (ISIC rev. 3, industry 50) consist of approximately 118,143 firms. This group has a sales share of 12.4 percent and an employment share of 9.1 percent. Firms in this group are considered separately from retailers and wholesalers because they can perform both retail and wholesale activities, and (sometimes) provide maintenance and repair services.

III.1 The longitudinal data set of distributive trade firms

Our principal data source of trade firms is the Annual Survey of Distribution (PAC) from 1996 to 2004.[11]

Firms registered in the Cadastro Nacional da Pessoa Jurídica (CNPJ) from the ministry of Economic Affairs and classified as distributive trade firms in the Cadastro Central de Empresas (CEMPRE) of the national statistical office (IBGE) are surveyed in PAC. The PAC dataset consists of two groups, namely a group of firms which surpass the threshold and are included by census and another group of firms which are below the threshold and are included by sample.

Firms with more than 20 employees or firms with less than 20 employees but with establishments in more than one Federal State are

10. In comparison, the number of establishments is 1.27, 1.11, and 0.33 million in Japan, the US, and the UK respectively. These establishments employ 7.14, 14.65, and 2.98 million workers respectively (Haskel et al., 2007). Thus, establishments are typically much smaller in Brazil on average.

11. A detailed discussion of the issues we face in constructing this data set can be found in appendix A.

included in PAC by census. For 1996, the initial year in the data set, this amounts to 26,838 distributive trade firms included by census. In 2004, the final year in our data set, the number of firms included by census has risen to 32,171. While firms included by census in PAC constitute a small share in the total population of trade firms (2.3 percent), their sales share is about 71.8 percent (IBGE, 2004). Firms included by census fill in an extended questionnaire and are required to report regional establishment data as well.

Registered firms with less than 20 employees are selected by means of a stratified random sampling procedure (the dataset has 12,402 sampled firms in 1996 and 10,596 sampled firms in 2004). Sampled firms are surveyed for a maximum of 3 consecutive years and fill in a simplified questionnaire. Because of the sample character, our empirical analysis focuses on firms included by census.

The main variables firms report in PAC are: the value of sales, the cost of goods sold, operational expenditures, financial expenditures, number of employees, and detailed location characteristics of the firm's headquarters and establishments. Firms also report establishment data of employment, payroll expenditures and the total volume of sales for each Federal state. Effectively this creates two units of analysis. If we examine decomposition results for the total economy, we use firm level data. However, if we examine productivity decompositions by Federal state, we use the reported establishment level data of firms by state.

Output and input variables are available to construct productivity measures. We measure labour productivity (LP) as the volume of sales divided by employment.[12] Since some retailers employ part-time workers, a preferable measure of labour input is hours worked. Data limitations force us to use employment. Productivity is therefore underestimated for retailers who employ relatively more part-time workers. However, the bias is probably small since there is little tradition of part-time work in Brazil due to resistance by unions (McKinsey, 1998). Nominal values are deflated using industry specific deflators.[13] We use the amplified consumer price

12. Since some retailers employ part-time workers, a preferable measure of labour input is hours worked. Data limitations force us to use employment. Productivity is therefore underestimated for retailers who employ relatively more part-time workers. However, the bias is probably small since there is little tradition of part-time work in Brazil due to resistance by unions (McKinsey, 1998).

13. Typically, statistical offices and the literature use sales divided by employment as a measure of productivity. However, this is a measure of real revenue per worker rather than physical output per worker. If price homogeneity applies within industries, or if within-industry price heterogeneity reflects the quality of products, then revenue productivity measures are appropriate. For US restaurants, Foster et al. (2008) show that using revenue productivity (sales divided by employment) gives comparable results to using physical productivity (physical output divided by employment).

index (INPCA) to deflate output measures (output measures are single deflated), where we use either Brazil's or the Federal states' price index for all goods or one of the following groups of goods: (1) clothing; (2) household equipment; (3) food and beverages. We divide industries into these groups according to the type of goods sold and deflate the revenue variables by the mid-yearly average of the corresponding price indexes.

Table 3 shows descriptive statistics for firms included by census. The statistics reported in this table should be interpreted while taking into account that we only include firms above the threshold. Output and input variables are reported for the full census data set and by entering, exiting, and continuing firms. Continuing firms are on average the largest firms. The average establishment size for continuers is 38 employees, compared to 28 for entering firms and 20 for exiting firms. Incumbents show the highest productivity and, surprisingly, exiting firms are marginally more productive than entering firms. [14]

Table 3

Descriptive statistics

	ALL FIRMS	CONTINUING FIRMS	ENTERING FIRMS	EXITING FIRMS
Real Sales	14.55	14.79	13.95	13.64
	(1.53)	(1.47)	(1.47)	(1.50)
Employment	3.62	3.78	3.32	2.89
	(0.85)	(0.82)	(0.62)	(0.86)
Labour productivity	10.94	11.02	10.62	10.76
	(1.17)	(1.10)	(1.35)	(1.26)
Payroll	12.33	12.53	11.86	11.58
	(1.11)	(1.07)	(0.89)	(1.11)
Establishment size	34.75	38.06	27.91	20.39
	(46.07)	(49.49)	(28.98)	(32.77)
Entry rate	0.131			
Exit rate	0.112			
N	171,035	129,489	22,379	19,167

Note: real sales, employment, labour productivity, and payroll are in logs. The entry and exit rates are the number of entrants divided by the total number of firms and the exiters divided by the total number of firms. The period is 1996 to 2004.

14. This finding might be related with distortions that make the exit process less rational. That is, less driven by market fundamentals but more by random factors (Bartelsman et al., 2005).

Table 4 Firms and establishments, 1996 and 2004

	1	2	3	4	5	6	7	8
Sector	**Total number of firms**	**Total number of establishments**	**Firms with >1 establishment**	**Number of firms with 1 establishment**	**Firms with 2-5 establishments**	**Firms with 6-10 establishments**	**Firms with 11-100 establishments**	**Firms with >100 establishments**
1996								
50	5,710	9,366	1,711	3,999	1,559	108	44	
51	6,683	12,815	2,120	4,563	1,810	194	114	2
52	14,445	42,793	6,685	7,760	5,314	813	541	17
of which:								
521	3,327	8,168	1,116	2,211	897	113	103	3
2004								
50	6,324	12,377	2,084	4,24	1,813	193	76	2
51	8,481	16,744	2,175	6,306	1,803	219	150	3
52	17,366	46,913	5,300	12,066	4,119	644	507	30
of which:								
521	4,684	10,906	924	3,760	716	110	88	10

Note: columns 4,5,6,7, and 8 add up to column 1. Columns 5,6,7, and 8 add up to column 3.

Entry and exit rates reveal substantial churning. The table reports entry rates of 13.1 percent and exit rates of 11.2 percent throughout the period from 1996 to 2004. In comparison, there appears more churning in distributive trade services in Brazil than in manufacturing industries in Latin American countries (see for instance Eslava et al. (2006); Bartelsman et al. (2005)). But the entry and exit rates we find for distributive trade firms in Brazil are comparable to that found in the distributive trade sector of OECD countries (see Foster et al. (2006); Bartelsman et al. (2005)).

III. 2 Characteristics of the distributive trade sector

In table 4, the number of firms by industry are shown for 1996 and 2004. Single establishment firms dominate Brazil's trade sector. And during 1996 to 2004 we find that single establishment firms continue dominating the trade sector. Thus, we find no strong tendency of multiple establishment firms (chains) replacing single establishment firms. However, we do find the increasing presence of very large chains (>100 establishments, see column 8). In particular, in food retailing the number of very large retail chains increased from 3 to 10 during the 1996 to 2004 period.

Concentration ratios of sales are shown in table 5. For this table, CR5 is the concentration ratio of the top 5 trade firms, and CR10 refers to the top 10. We find little concentration of sales in wholesale trade (industry 51), and the table suggests concentration declined from 1996 to 2004. For retailers (industry 52) we find a higher concentration ratio (CR10 = 0.23 in 1996). And sales becoming more concentrated (CR10 = 0.27 in 2004). This partly reflects the entry and market expansion by large (inter)national retail chains. Indeed, we observe a similar concentration for food retailers (industry 521). Both an increasing number of very large chains (table 4) and higher concentration ratios (table 5) in retailing correspond with findings by Saab and Gimenez (2000) and Concha-Amin and Dias de Aguiar (2006). However, in comparison to advanced OECD countries, concentration ratios in distributive trade industries are low (Boylaud and Nicoletti, 2002; Haskel and Sadun, 2007).

Table 5

Firm concentration of sales by industry

	CR5	CR10	NUMBER OF FIRMS
1996			
INDUSTRY			
50	0.02	0.04	5,710
51	0.23	0.30	6,683
52	0.16	0.23	14,445
OF WHICH			
521	0.27	0.35	3,327
2004			
INDUSTRY			
50	0.03	0.04	6,324
51	0.11	0.15	8,481
52	0.20	0.27	17,366
OF WHICH			
521	0.31	0.39	4,684

Note: CR5 is concentration ratio of top 5 sales firms, CR10 refers to top 10.

To gain an initial understanding of productivity dynamics, we study the transition of wholesale and retail trade firms in the overall productivity distribution during 1996 to 2004. In each year, we classify firms into quintiles of the labour productivity distribution. We measure the productivity of a firm relative to the weighted average productivity of the industry. By removing industry effects, the quintiles capture relative productivity within detailed (4digit) industries.

Table 6 shows the transition matrix. We construct this matrix in a manner similar to Foster et al. (2002). Firms can be traced to where they came from in 1996. Quintile 1 is the lowest productivity, quintile 5 is the highest. Each cell shows where the firms that were in a given quintile in 1996 are in 2004.[15]

15. A backward-looking matrix, of where firms in 2004 came from, shows similar results.

Table 6

Matrix of relative productivity in 1996 and 2004

FIRM GROUP		Quintile 1 (2004)	Quintile 2 (2004)	Quintile 3 (2004)	Quintile 4 (2004)	Quintile 5 (2004)	Deaths	Row total
QUINTILE 1	(1996)	9.6	7.9	4.3	2.3	1.5	74.4	10.5
QUINTILE 2	(1996)	5.5	9.8	10.1	5.9	2.9	65.8	10.4
QUINTILE 3	(1996)	3.9	8.4	12.2	11.5	5.2	58.8	10.4
QUINTILE 4	(1996)	2.6	5.4	11.4	17.0	11.9	51.8	10.4
QUINTILE 5	(1996)	1.4	3.3	6.7	13.2	24.2	51.1	10.4
BIRTHS		23.7	21.0	18.9	17.8	18.6		48.0
COLUMN TOTAL		13.8	13.7	13.7	13.7	13.6	31.4	100.0

Note: Quintile 1 is the lowest productivity, quintile 5 is the highest. Each cell shows where the rms that were in a given quintile in 1996 are in 2004.

We find a large role of births and deaths. For any quintile, a firm in 1996 has the highest probability of dying before 2004 although deaths are concentrated in firms with low productivity in 1996. For example, 74.4 percent of firms in the lowest quintile in 1996 did not survive until 2004. A smaller (but still fairly large) fraction of 51.1 percent of firms in the highest quintile in 1996 did not survive until 2004. Births arrive uniformly throughout the productivity distribution, with a slightly larger fraction arriving in the lowest quintile. In addition, we find substantial persistence in productivity rankings among firms that do survive. Firms in the bottom quintile in 1996 had a 9.6 percent chance of staying in the lowest quintile in 2004, but only a 1.5 percent chance of moving to the highest quintile. Likewise, firms in the top quintile in 1996 had a 24.2 percent chance of staying in the highest quintile, but only a 1.4 percent chance of moving to the lowest quintile.

In comparison with transition dynamics in the US (Foster et al., 2002) we find the following.[16]First, in both the US and Brazil births and deaths play a large role. But differences in deaths across quintiles between the US and Brazil suggests the selection process is less driven by market fundamentals but more by random factors in the latter, which could be due to differences in institutions and market structure (Bartelsman et al., 2005). For example, in Brazil 51.1 percent of trade firms in the highest quintile did not survive during the 1996-2004 period. This compares with 39.2 percent in US retail during the 1987-1997 period. A more random entry and exit process in Brazil lowers the contribution of net-entry to growth. Second, the persistence in productivity rankings of surviving firms is higher in Brazil than in the US. For example, in Brazil trade firms in the lowest quintile had a 1.5 percent chance of moving to the highest quintile. In the US, the chance of moving to the highest quintile is 2.8 percent. Higher persistence in productivity rankings suggest a higher degree of dualism in the Brazilian economy. A higher persistence in productivity rankings lowers the contribution of between-firm market shares change to growth.

The differences in productivity across trade firms within industries and the large role of births and deaths motivate us to decompose productivity change into the contribution from within-firm productivity change, bet-ween-firm market shares change (reallocation of resources to higher

16. The comparison is not exact because Foster et al. (2002) examine retail trade firms during the 1987-1997 period, while we examine wholesale and retail trade firms during the 1996-2004 period. Differences in the business cycle between the US and Brazil might blur differences in market dynamics. Therefore, some care should be taken in interpreting differences between the US and Brazil.

productivity firms), and the entry and exit of firms. In the next section we present the method, before turning to the results in section 5.

IV. THE PRODUCTIVITY DECOMPOSITION METHOD

We start with the preliminaries of the productivity decomposition (Balk, 2001). Aggregate productivity, *LPA*, is the weighted geometric average of firms' productivity:

$$LP_t^A = \prod_i LP_{it}^{\theta_{it}}$$

where subscript *i* and *t* refer to firm and time respectively, θ is a firm specific share in total employment, and *LP* is labour productivity. If we take the logarithm of productivity, the aggregate productivity level is defined as a weighted arithmetic mean:

$$\ln LP_t^A = \sum_i \theta_{it} \ln LP_{it}$$

Aggregate productivity growth between two periods is the percentage change measured by:

$$\Delta \ln LP^A = \ln LP_t^A - \ln LP_{t-\tau}^A$$

Aggregate productivity growth between two periods is either due to intra-firm productivity change or due to inter-firm reallocation of market share. Intra-firm productivity change is, for instance, the result of investment in new technologies and organizational change. Inter-firm reallocation of market share is the result of a dynamic market process, where firms expand, contract, enter the market, or leave the market.

For the decomposition, consider two periods and three types of firms. Continuing firms are denoted by C, entering firms are denoted by E, and exiting firms are denoted by X. Firms in the first period (t-τ) either continue or exit the market between the first and second period. So in period t-τ, $C \cup X$ firms are active. In the second period (t), only firms that continued or entered the market between the frst and second period are present. Hence in period t, $C \cup E$ firms are active.

Aggregate productivity growth between two periods can therefore be decomposed into:

$$\Delta \ln LP^A = \ln LP_t^A - \ln LP_{t-\tau}^A = (\sum_{i \in E} \theta_{it} \ln LP_{it} + \sum_{i \in C} \theta_{it} \ln LP_{it}) \\ -(\sum_{i \in X} \theta_{i,t-\tau} \ln LP_{i,t-\tau} + \sum_{i \in C} \theta_{i,t-\tau} \ln LP_{i,t-\tau}) \quad (4)$$

Equation 4 is the basic decomposition of productivity growth. It shows that aggregate productivity can be decomposed into the contribution of entering, exiting, and continuing firms. However, the contribution from continuing firms is due to both intra-firm productivity changes and inter-firm relative size changes. Preferably, these effects from continuing firms are separated. Several methods have been developed to distinguish between these two contributions from continuing firms.[17]

In this paper we follow the decomposition method developed by Griliches and Regev (1995), hereafter denote GR:[18]

$$\Delta \ln LP^A = \sum_{i \in E} \theta_{it} \left(\ln LP_{it} - \frac{\ln LP_t^A + \ln LP_{t-\tau}^A}{2} \right) \\ + \sum_{i \in C} \left(\frac{\theta_{it} - \theta_{i,t-\tau}}{2} \right) \left(\ln LP_t + \ln LP_{t-\tau} \right) \quad (5) \\ + \sum_{i \in C} \left(\theta_{it} - \theta_{i,t-\tau} \right) \left(\frac{\ln LP_t + \ln LP_{t-\tau}}{2} - \frac{\ln LP_t^A + \ln LP_{t-\tau}^A}{2} \right) \\ - \sum_{i \in X} \theta_{i,t-\tau} \left(\ln LP_{t-\tau} - \frac{\ln LP_t^A + \ln LP_{t-\tau}^A}{2} \right)$$

The terms on the right hand side of equation 5 are:

- The *entry effect*: the sum of differences in the entering firm's productivity and average aggregate productivity, weighted by the firms' market share. This term measures the contribution of entering firms to growth.

17. See Balk (2001) for an overview.

18. This method has the advantage that it avoids the mixing of Paasche-type measures with Laspeyres-type measures by using a symmetric decomposition method (Balk, 2001). In addition, by taking period averages, the influence of possible measurement errors become smaller. The disadvantage of the GR method is that, because of taking averages, the within-firm effect is affected by changes in the market share, and the between-firm effect is affected by changes in productivity. An alternative decomposition method proposed by Foster et al. (2002) uses a Laspeyres-type measure and more clearly distinguishes between within-firm and between-firm effects. But at the expense of introducing a cross-term and greater vulnerability to measurement error. Findings for the relative contribution of decomposition components are simila

- The *within-firm effect:* the sum of productivity change within continuing firms, weighted by the firm's average market share. This term reflects gains from productivity growth within firms.
- The *between-firm effect:* the sum of productivity change due to the expansion or contraction of continuing firms, where firm's average productivity is measured in deviation from average aggregate productivity. This term captures productivity gains from the expansion of high productivity firms, or the contraction of low productivity firms.[19]
- The *exit effect:* the sum of differences in the productivity of exiting firms and average aggregate productivity, weighted by initial market shares. Exiting firms contribute positively to aggregate productivity growth if the firms exhibit productivity below average productivity.

The relative contributions of the various terms speak to growth models. Neoclassical growth models imply large within-firm effects, whereas models of growth through creative destruction are related with between-firm market-share changes and net-entry effects. In addition, the decomposition results can be related with the major political and technological changes during the period analysed.

V. PRODUCTIVITY GROWTH DECOMPOSITION RESULTS

We present productivity decomposition results from using equation 5 in this section. We perform productivity decompositions at the industry level (four digits). Results are reported at the two digit level, for food retailers (ISIC rev. 3, industry 521), and for the total trade sector. The weights which are used to average across industries are nominal gross output by industry averaged over the first and last year of the period for which the change is measured. We decompose growth annually and present period averages.

19. Recently, Petrin and Levinsohn (2008) argue that measuring reallocation by using differences in productivity is an inappropriate measure, because in equilibrium firms equate marginal products with marginal costs irrespective of their productivity. For example, if firms operate under decreasing returns to scale, an input movement would affect our reallocation term even though all firms might still equate marginal products with marginal products and therefore there should not be a growth contribution from this input movement. However, if reallocation is measured by using differences in the gaps between marginal products and input prices, the input movement would not affect growth. While the approach suggested by Petrin and Levinsohn (2008) warrants serious attention, the empirical implementation of the suggested alternative decomposition method is difficult to achieve and has not yet been implemented.

In table 7, the GR decomposition of productivity growth by using equation 5 is shown.[20] During the 1996 to 2004 period, average annual productivity growth was 1.8 percent for the total distributive trade sector. But growth was higher in wholesale trade (3.9 percent) than retail trade (1.1 percent). And growth was higher in the 20002004 period than the 19962000 period in wholesale and retail trade, but not in food retailing (industry 521).[21] In fact, productivity of food retailers declined during the 20002004 period.[22]

The within-firm effect, or intra-firm productivity change, is the largest contributor to growth in most industries. This might reflect the positive effect on firm performance from the adoption of ICT (we examine scale related productivity growth below), and the shift from financial to operations management after the introduction of the Real plan. In addition, the relatively large within-firm effect suggests that a neoclassical growth model underlies aggregate productivity growth in the distributive trade sector of Brazil.

If resource allocation improves, this shows up as a positive and large between-firm effect, arising from factor reallocation from low-productivity to high-productivity trade firms. We find a positive but modest between-firm effect, which suggests that despite liberalisation of services markets, resource reallocation did not improve much during the 19962004 period. This finding is consistent with the high persistence in productivity rankings, which lowers the contribution of between firm market shares change to growth (see table 6).[23]

20. Several caveats apply. First, small firms are not included. However, small firms (either registered or unregistered) are prevalent in the Brazilian economy. In particular, small firms prevail in the retail industry. The decomposition results can be affected by the exclusion of small firms, although it should be noted that firms which are included in the data set have a sales share of 72.6 percent in 2004. Second, firms in several northern regions which are located outside the Federal States' capital are not included in the survey because of the high costs involved in collecting information for these firms. These regions are: Rondónia, Acre, Amazonas, Roraima, Pará, Amapá, and Tocantins. Thirth, since there is a census threshold, entrant firms in our dataset may not be true entrants but simply firms that grow beyond the threshold. We addressed that limitation by artificially raising the threshold and examining changes in the decomposition results. Our findings suggest that the absolute value of the decomposition results is affected by the threshold, but not the relative contributions of the components.

21. Our growth figures broadly agree with but do not exactly match those presented by IBGE in the national accounts. The match is not exact, because we concentrate on firms included by census.

22. Negative productivity growth in food retailing might be due to the expansion in services offered (such as amenities and the breadth of assortment), which is not accounted for in the output measure we employ (Ratchford, 2003).

23. An exception is retail trade during 1996-2000, where between-firm effects are as large as within-firm effects.

Our finding for Brazil contrasts with studies of the distributive trade sector in OECD countries (in particular the US and the UK), which find that reallocation dynamics account for most growth in these countries (Foster et al., 2006; Haskel and Sadun, 2007; Matsuura and Motohashi, 2005).[24]

Differences in the growth contribution from reallocation dynamics between Brazil and developed countries may result from higher business regulation in the former (World Bank, 2006).

The net-entry effect is negative for most industries and period averages (see table 7). This is due to two reasons. First, the productivity of entrants is below average productivity (see also table 3). The negative contribution to growth from the entry of new firms is a common finding in the literature. For example, Bartelsman et al. (2005) find that the productivity of entrants is below average in the manufacturing sector of OECD and Latin American countries. Generally, it is assumed that below average productivity of entrants is the result of market experimentation, and that selection and learning effects eventually lead to a positive growth effect from entrants.[25]

Foster et al. (2008) offer an alternative explanation for this result. Since we measure productivity as sales divided by employment, our productivity measure will be influenced by firm specific prices. Foster et al. (2008) show, for US manufacturers, that entrants charge lower prices than incumbents. If this applies to entrant trade firms in Brazil as well, we understate the productivity of entrants. Second, the productivity of exiters is below average productivity which affects growth positively, but this effect is dominated by the negative effect from entrants eventually resulting in a negative net-entry effect.

In figure 1, the relationship between FDI and the components of growth are shown. Each observation refers to a Federal state, and we present a simple linear relationship. We scaled FDI stock relative to the state's GDP.[26]

The relationship between FDI and aggregate productivity growth is positive. For the components of growth, we find that the relationship between FDI and within-firm productivity change is positive And the relationship between FDI and between-firm market share changes is positive as well. This positive relation indicates that improvements in

24. Between-firm effects include the contribution of new establishment from continu-ing firms to growth.

25. If we increase the time horizon of the productivity decomposition, the net-entry effect increases at the expense of within-firm effect and between-firm effect. Thus, new firms enter the market with below average productivity, but their productivity growth is higher than incumbents

26. FDI stock is from the Censo de Capitais Estrangeiros, Central Bank of Brazil. Regional GDP data is obtained from the Contas Regionais do Brasil (IBGE, 2002).

allocative efficiency are higher in states with relatively more FDI investment, although not significant at the 10 percent level. We find a marginally positive but insignificant relationship between FDI and net-entry effects.[27]

Table 7
Productivity growth decomposition

Industry	Average annual growth	Contribution from:		
Period	(in percentage points)	Within firm effect	Between firm effect	Net entry effect
Total				
1996-2000	1.6	2.3	0.6	-1.3
2000-2004	2.0	4.8	0.6	-3.4
1996-2004	1.8	3.6	0.6	-2.4
50				
1996-2000	3.5	2.4	0.8	0.3
2000-2004	3.1	3.1	1.1	-1.1
1996-2004	3.3	2.7	0.9	-0.4
51				
1996-2000	3.6	4.6	0.5	-1.5
2000-2004	4.2	7.8	0.2	-3.9
1996-2004	3.9	6.2	0.3	-2.7
52				
1996-2000	1.1	1.5	1.5	-1.9
2000-2004	1.2	4.1	1.0	-4.0
1996-2004	1.1	2.8	1.3	-2.9
of which				
521				
1996-2000	1.4	2.7	0.4	-1.7
2000-2004	-0.3	3.3	-0.7	-2.9
1996-2004	0.6	3.0	-0.1	-2.3

Note: GR Decomposition of labour productivity growth.
Percentage points contribution to average annual growth.

27. In this fgure, the net-entry effect is defined slightly different because an entry not only originates from new firms but also from new establishments in states by continuing firms from other states. We excluded Maranhao, Rio de Janeiro, and Sao Paulo in figure 1 because the high ratios for these states would suggest that these observations drive the obtained relationships. However, if we include these regions we find the same results. But the positive relationship between FDI and between-firm market share changes is weaker and still insignificant.

Productivity levels and growth by size class are shown in table 8. Larger firms show above average productivity. In addition, the productivity gap between the smallest firms (119 employees) and the large to medium sized firms increased during the 19962004 period.[28]

This indicates productivity growth is higher in larger firms. In addition, the last column in table 8 indicates that growth increases with firm size although not uniformly. Our finding that productivity change is higher in larger firms might be related with the finding that ICT adoption is related with scale (Doms et al., 2004). That is, ICT adoption and hence productivity improvements are higher in larger firms. However, we are not able to examine this issue further due to lacking ICT investment data for Brazilian trade firms.

Throughout this paper, we use real sales divided by employment. Using sales as an output measure raises the productivity of firms which sell goods with a higher value content. In particular, when hyperinflation ended with the successful introduction of the Real plan, the increase in purchasing power stimulated demand for goods with a higher profit margin. And this increased demand for higher margin goods would be reflected in higher sales volumes and gross margins. Therefore, table 9 shows decomposition results from alternative productivity measures. We consider gross margin divided by employment (LPGM) and value added divided by employment (LPVA).[29]

We find that aggregate growth and its components depend upon the choice of the productivity measure. In particular, aggregate growth is lower if we consider gross margins or value added as the relevant output concept during the 19962000 period. Aggregate growth is higher for the alternative output concepts during the 20002004 period. Importantly, during 1996 to 2000 the within-firm effect is substantially smaller if we decompose value added productivity growth. This finding suggests that part of the increase in productivity (measured by sales), during the years immediately following the introduction of the Real plan, is explained by the increased demand for higher margin goods.

28. To examine productivity growth across size classes, we use data for the entire population from the official publications (IBGE, 1996, 2004). Data for the entire population does not allow us to distinguish food retailers.

29. Because of data constraints, we do not decompose the movements in labour productivity into changes in capital intensity on the one hand and total factor productivity on the other.

VI. CONCLUSION

We decomposed productivity growth within detailed distributive trade industries into the contribution from entering, exiting, and continuing firms during 19962004. The decomposition analysis sheds light on the relative contribution to growth from within-firm productivity change, between-firm market shares change, and the entry and exit of firms. Decompositions of aggregate productivity growth speak to one of the two models of economic growth. Neoclassical growth models imply large within-firm effects, whereas models of growth through creative destruction are related with between-firm marketshare changes and net-entry effects.

We find three main results. First, the distributive trade sector of Brazil is characterized by small (single establishment) trade firms which account for most employment but only a small fraction of sales. Larger firms account for 23 percent of the total population of trade firms but 70-80 percent of sales. We find no strong tendency of multiple establishment firms (chains) replacing single establishment firms, although we do find the increasing presence of very large chains in food retailing during the 1996-2004 period. Second, most growth is accounted for by within-firm productivity change during the 1996-2004 period. The large within-firm effect suggests that a neoclassical growth model underlies aggregate productivity growth in the distributive trade sector of Brazil. Third, we find a positive relation between foreign direct investment (FDI) and withinfirm productivity changes, and between FDI and reallocation dynamics across the Federal states of Brazil. But the latter effect is insignificant. The decomposition indicates that reallocation effects are modest despite the liberalization of services markets during the 1990s. Our findings of the distributive trade sector in Brazil are different from that in OECD countries, where reallocation dynamics play an important role in accounting for growth (Foster et al., 2006; Haskel and Sadun, 2007; Matsuura and Motohashi, 2005).

While we find that within-firm effects dominated in accounting for growth in Brazil's trade sector, the largest potential for future productivity growth is from reallocation dynamics. Current growth and macroeconomic stability might start a process where chains of convenience stores with bargaining power, centrally performed operations, and best practice operations replace single shop convenience stores. This process has been under way for some time in OECD countries and explains most productivity growth in these countries (Foster et al., 2006).

Table 8

Productivity levels and growth by size class

Industry	ln(Sales/Employment)	ln(Sales/Employment)	average annual growth
Employees	**1996**	**2004**	**(%)**
50			
1-19	4.11	3.41	8.71
20-49	4.70	4.97	3.35
50-99	4.89	5.32	5.40
100-249	5.23	5.44	2.69
250-499	5.30	5.59	3.60
500+	4.71	5.36	8.19
51			
1-19	4.34	4.34	0.02
20-49	4.76	5.15	4.97
50-99	4.95	5.38	5.33
100-249	5.06	5.64	7.32
250-499	5.37	5.58	2.61
500+	5.97	6.39	5.34
52			
1-19	3.17	3.18	0.10
20-49	3.84	3.96	1.48
50-99	4.00	4.05	0.68
100-249	4.12	4.15	0.41
250-499	4.06	4.21	1.85
500+	4.61	4.49	1.47

Note: Unweighted average productivity by size class. Souces: Pesquisa Anual de Comércio 1996 and Pesquisa Anual de Comércio 2004.

Table 9
Differences in decomposition components from alternative productivity measures

	Δ Overall Growth (in percentage points)	Contribution from:		
		Δ Within-firm effect	Δ Between-firm effect	Δ Net entry effect
LPGM				
1996-2000	-0.9	0.1	-0.4	-0.5
2000-2004	1.6	1.6	-0.5	0.5
1996-2004	0.4	0.9	-0.4	0
LPVA				
1996-2000	-3.3	-2.9	-0.3	-0.1
2000-2004	1.5	0.3	-0.5	1.7
1996-2004	-0.9	-1.3	-0.4	0.8

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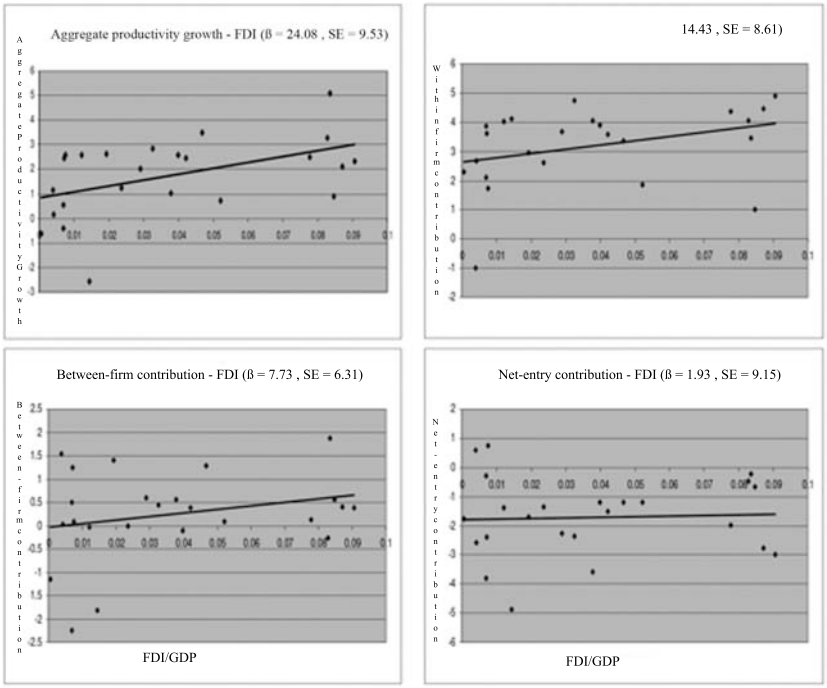
Figure 1

Relationship FDI and components of growth



Note: Ordinary Least Squares fit. Decomposition for the 1996-2004 period. 24 observations, each referring to a Federal state of Brazil. The slope coefficients for the relationship between the between-firm contribution and FDI, and for the net-entry contribution and FDI are insignificant at the 10 percent level.

A. DATA APPENDIX

A.1 Data cleaning

IBGE has the policy to encrypt the identification number of firms (CNPJ) before giving researchers access to the data. The method which is used to encrypt identification numbers is equal across years. Therefore, a firm can be traced throughout the sample. We inspected the encrypted firm ID's and deleted firms with duplicate numbers.

We used the following procedure to detect outliers before the productivity decomposition. First, nominal output is divided by nominal input for each firm. Observations of nominal output divided by nominal

input that fall into the first and the ninety-ninth percentile of the distribution at the most detailed industry classification (four digits) are identified as outliers. After two periods have been linked, firms with outlying productivity values or missing data in one of the two periods are deleted. Entrant and exiting firms are determined from the remaining data. We also decomposed productivity growth without the outlier procedure. Results from these decompositions are similar.

A.2 Price Deflators

Several industry wide and economy wide price indices are available for Brazil. Choices, however, are limited. We worked with price indices at fairly aggregated levels. Because retail firms sell goods to consumers, we used the consumer price index to deflate output. Consumer price indices (Índices Nacionais de Preços ao Consumidor Amplo, INPC-A) are available at IBGE. We used the overall CPI to deflate output of retail firms. In some cases it was possible to use more detailed price series, for example for firms selling food and drinks. Because of missing reliable output deflators for wholesale trade firms, we used consumer price indexes to deflate output for these firms as well. In PAC, firms report economic numbers that refer to the calendar year of the survey. Firms whose business year differs from the calendar year are required to adjust their numbers accordingly. Therefore, we used annual (midyear) price deflators to deflate output.

A. 3 Conversion of CNAE to ISIC Revision 3.0

Different national sector definitions are used in PAC over time. We used data in PAC from 1996 to 2004. Two national classifications are therefore relevant. First, the CNAE classification (Classificaçao Nacional de Atividades Económicas), which was adopted in 1995 and used until 2003. Second, from 2003 onwards, the CNAE 1.0 classification.

Our approach has been to first convert CNAE 1.0 in later surveys to CNAE. We followed this approach because only two years with the new classification are available. Next, we converted CNAE to the International Standard Industry Classification Revision 3.0 (ISIC Rev. 3.0). At the one and two digit level, the industry classifications CNAE, CNAE 1.0, and ISIC Rev. 3.0 are identical. Differences between the classifications only occur at the three and four digit level. Usually, more detail is offered in the CNAE/CNAE 1.0 classification and aggregation of CNAE/CNAE 1.0 to

groups recomposes ISIC groups. We describe the conversion CNAE x CNAE 1.0 and CNAE x ISIC Rev. 3.0 below.

First, consider the conversion of CNAE 1.0 to CNAE for distributive trade firms. The difference between both classifications is not large. For 68 out of 72 (four digit) industry categories, an exact matching exists. The lack of unique correspondence between both classifications in the remaining 4 categories concerns wholesale of machinery, equipment and supplies and retail trade not in stores. Differences arise, because CNAE 1.0 does not distinguish between the different forms of commercialisation. For example, whether sales take place via a store, TV, or internet, is no longer separated in the new CNAE 1.0. This distinction is made in CNAE (and it is made in ISIC Rev. 3.0). This implies that no strict correspondence between both classifications exists.

Firms that belong to CNAE 1.0 industry code 51.640 and 51.659 all belong to a similar aggregate category in CNAE, namely 51.6 (CNAE). Firms in CNAE

1.0 51.640 are all converted to CNAE 51.624, and firms in CNAE 1.0 51.659 are converted to CNAE 51.632. Firms in CNAE 1.0 52.620 are converted to CNAE 52.698, but some firms in CNAE 52.698 are moved to CNAE 1.0 64.122. These firms can no longer be traced and artificially disappear from the data set.

Firms in CNAE 52.612 and some firms in CNAE 52.698 are difficult to trace, because CNAE 1.0 does not distinguish between the various forms of commercialisation. IBGE (2004) indicates that in the total population of retailers, 5 retailers realized 100 percent of their sales via the internet, 40 via the tv, and 584 via other forms of commercialisation. In a total sample of 1,16 million retailers, the bias is unlikely to be large. Furthermore, we focus in the productivity decompositions on broader aggregates so to some extent these firms are possibly recomposed in an aggregate.

Second, we converted firms in four digit CNAE sector classifications to four digit ISIC Revision 3.0 classifications. In fact, since CNAE is based on ISIC Rev. 3, matching is unique. The only difference between both classifications stems from more detail in the CNAE classification. Hence more detailed categories in CNAE are recomposed in a broader ISIC category.

A. 4 Firm Dynamics

To estimate the contribution of firm dynamics to growth, it is important to measure 'truly' entering and exiting firms. We use unique firm identification numbers to measure entrants, exiters and continuing firms. But some characteristics of PAC cloud the measurement of true entrants and exiters.

The structure of some firms change during the period analysed. For example, the structure of some firms change because of mergers, takeovers, and spin-offs. A firm that is taken over, continues operating. But the firm now has a different firm identification number (the same as the firm that has purchased her). Due to the takeover, the previous firm identification number disappears. Without additional information about changes in the structure of firms, we would count a "false" exit. Other studies solved this problem by including information from business registers. We are partly able to solve this problem, because PAC asks firms to report changes in legal and economic status (mudanças na estrutura da empresa). Furthermore, if a change in the legal or economic status of the firm occurs, the firm reports an additional tax number link (PAC provides two firm identification numbers in these cases). Therefore, the additional tax number link changes its meaning depending upon the change in legal or economic status.

Consider the possible changes in the structure of trade firms. First, if no change is reported, the firm can be linked directly. However, note that the industry classification of a firm could change. This happens with a change in its main economic activity. Firms that switched between industry classifications are dropped from the data set. Second, a new firm can emerge from a merger. The merged firm has 2 predecessors. Because we need two additional tax number links (in stead of one) and because the newly emerged firm is often restructured considerably, we consider it a new entrant. Likewise, if a firm emerges from a complete split-up, we considered it a new entrant. The argument for making these choices is that this firm now stands alone and gains experience on its own. Third, consider a partial spin-off. A new firm emerges from a parent firm. We considered it a new firm, again, on the assumption that this new firm stands alone and gains experience on its own. Fourth, if the firm reports that she is acquired by another firm or she has acquired another firm, we should ideally add output and input data for both firms. So, output and input data of the firm that is acquired should be added to the purchasing firm. We were not able

to do so, and this therefore results in a bias in the decompositions. Fifth, a 'rest' category exists, where firms report other reasons for a change in its tax number link in 'observaçãos.' Here, observations for old and new firm identification numbers were treated as one firm.