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Are gross job flows in Australia sensitive to exchange rate fluctuations?

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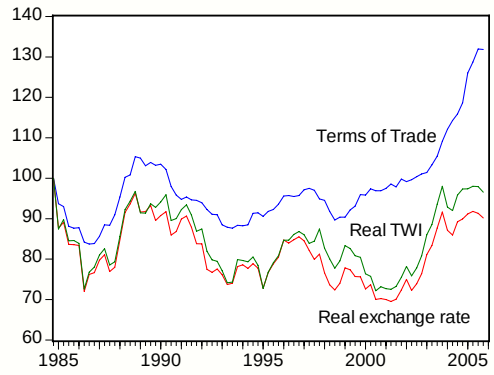
1. Introduction

Several studies reveal that labour markets in countries like Australia are in a constant state of flux (for example, U.S. studies by Blanchard and Diamond, 1990; Davis and Haltiwanger, 1990, 1992; Ritter, 1993, 1994; Davis *et al.*, 1996; U.K. studies by Konings, 1995; and Australian work by Borland, 1996; Mumford and Smith, 2003). Specific jobs are continually created and destroyed as firms expand, adjust to changing labour force characteristics, restructure, contract or close. Job creation and job destruction are simultaneous processes such that gross job flows swamp net employment changes over time. In this paper we study whether these fluctuations are driven by external shocks operating through the real exchange rate.

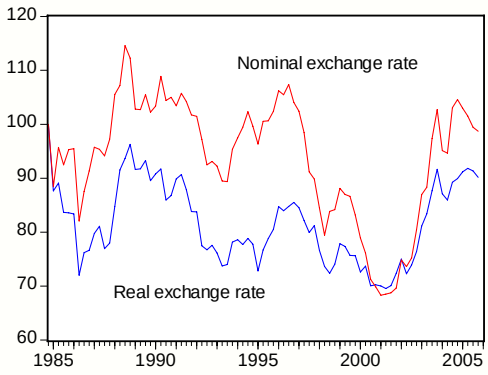
International trade is alleged to bring welfare gains via the "reallocation of resources to their most productive uses" (Klein *et al.*, 2003: 239). However, reallocations bring adjustment costs which may be significant and persistent. Accordingly, any evaluation of the net benefits of reallocations driven by trade must consider these costs. In this paper, as an exploratory exercise we consider the impact of real exchange rate movements on rates of job creation and job destruction in Australia.

Over the last twenty years Australia has been subjected to large swings in its terms of trade (measured as the ratio of export to import prices) which have been reflected in similar swings in the nominal exchange rate and the real exchange rates. The large relative price swings may significantly impact on the profitability and competitiveness of all industries that trade in international markets. The basic causality that might underpin this hypothesis relies on the nominal exchange rate being more variable than the real exchange rate (see Mussa, 1986; Gourinchas, 1998, 1999). Figure 1(b) confirms that since 1985 this has been the case in Australia. Fluctuations in nominal exchange rate changes also drive real exchange rate changes because prices are less volatile (Mussa, 1986).

Figure 1 Terms of Trade, Nominal and Real exchange rate indexes, Australia, 1985 to 2006



(a) Terms of Trade, real TWI and real exchange rate



(b) Nominal and real exchange rate

Source: RBA Bulletin database, authors' calculations. 1985 to 2006, 1985:1 = 100

Most of the literature on gross job flows and the related model development in recent years has been based on what are now accepted stylised facts that were first outlined in Davis and Haltiwanger (1990). Accordingly, job creation and destruction are considered to be simultaneous processes and subsequently gross flows swamp net flows. Aggregate fluctuations are dominated by short periods of sharply increasing job destruction. During periods of recession, job destruction is rapid and sizeable whereas job creation may initially decline but resumes prior to the end of the job destruction wave. The job creation that occurs during the recessionary phase may be a substitution of part-time for full-time employment (Mitchell *et al.*, 2005).

Orthodox economic theory hypothesises that exchange rate movements will alter sectoral resource usage such that exchange rate depreciation will increase demand for resources (labour included) in the traded-goods sector and reduce demand in the non-traded goods sector. Gourinchas (1999: 1280) notes that the problem with these simple models is that they have "nothing to say about the gross margins that bring about a given change in sectoral employment. For instance, a given *net* sectoral employment decline can be brought about through a simultaneous decline in job creation and destruction … or opposite changes in gross flows." Clearly, the welfare impacts of these options are starkly contrasted.

In this paper, we seek to examine the response of gross employment flows to real exchange rate movements in Australia. There have been no Australian studies covering the impact of exchange rates on gross job flows.

The first conceptual issue confronted in the paper is that real exchange rate movements are not fully exogenous because, in part, they respond to aggregate shocks including domestic monetary policy variations. For Australia, over the sample period of this study (1985 to 2006), there have been clear cases when the Reserve Bank of Australia (RBA) has changed monetary policy in response to external pressures (particularly in the late 1980s). We follow Gourinchas (1998) and Klein *et al.* (2003) and create a de-trended measure of real exchange rate shocks which are exogenous to the domestic economy. We seek to test the hypothesis that real exchange rate appreciation does not significantly impact on gross job flows (rates of job creation and job destruction) in non-traded industries but promotes job reallocation away from industries which are more externally exposed.

Much of the extant literature considers only manufacturing industries, which may not represent the dynamics of the other sectors in the economy and whose employment share is declining. We extend Klein *et al.* (2003) by broadening the focus beyond manufacturing. We group 3-digit industries by Ritter's (1994) broad industry groupings, Goods-producing (G); Trade-Services (T); and Remaining-Services (R). We build on Mitchell, Myers and Juniper (2005) and use reduced-form regression models to test the hypothesised sensitivities outlined above. In doing so, we assert that the Goods-producing sector by composition (dominated by manufacturing) is more externally exposed and more sensitive to real exchange rate movements than the services sectors. Subsequent research by the authors will more thoroughly investigate the hypotheses using sector-specific measures of the degree of openness and bi-lateral industry-specific real exchange rate measures for exporting, import-competing, importing, traded and non-traded industries at the 4-digit level.

Our results show that gross job flows in the Goods-producing sector are significantly impacted by exchange rate fluctuations, with an appreciation increasing both job creation and destruction rates and hence job reallocation. However, job destruction does not dominate the adjustment process. Trading-services sector job destruction rate is marginally and negatively responsive to exchange rates, with the Remaining-services sector unresponsive.

The paper is laid out as follows. Section 2 provides a brief literature review. Section 3 shows how we construct the gross job flow measures and Section 4 analyses their dynamic behaviour for the three broad groupings noted above, in addition to . Section 5 reports the results of the reduced-form regressions. Concluding remarks follow.

2. Brief literature review

A plethora of literature has studied the impact of real exchange rate movements on employment gross job flows in many countries including Burgess and Knetter (1998) for the G-7; U.S. studies by Gourinchas (1998), Klein (2003), and Campa and Goldberg (2001); a US and UK study by Faria and Leon-Ledesma (2005); French studies by Gourinchas (1999) and Hatemi-J and Irandoust (2006); Latin American countries by Haltiwanger *et al.* (2004); an Asian study by Christopoulos (2004); a Korean study by Kim (2005); and a Japanese study by Dekle (1998).

Several findings are common. In terms of sectoral responsiveness, traded-goods industries exhibit greater sensitivity and persistence to exchange rate fluctuations (Gourinchas 1999; Kim 2005). Other things equal, an appreciation contracts net employment through lower job creation and higher job destruction in export and import-competing industries, and increases importing employment through higher job creation and lower job destruction (Gourinchas 1998; Goldberg and Tracy 1999). Gross flows are generally found to react asymmetrically to real exchange rate changes such that job destruction is more persistent and responsive, particularly to adverse shocks than job creation (Gourinchas 1998; Klein *et al.* 2003). Further, import-competing industries are generally found to be more sensitive to exchange rate shocks than export industries (Suarez, 1998; Tomiura 2004; Goldberg *et al.*, 1999). Gourinchas (1998) found similar job destruction responses for export and import-competing sectors, but sharper import-competing job creation response to a depreciation. The estimates of sensitivity vary markedly across different levels of spatial, period and industry disaggregation (Goldberg *et al.*, 1999; Klein *et al.*, 2003; Campa and Goldberg 2005).

Much of the extant literature considers only manufacturing industries, which may not be representative of the dynamics of other sectors in the economy. Further, manufacturing represents an ever-diminishing employment share. Most of the studies that address this issue, find that gross job flows in manufacturing and non-manufacturing behave differently (for example, Ritter, 1994; Mumford and Smith 2004; Armington and Acs, 2004; Mitchell *et al.*, 2005). Ritter (1994) found that the dynamics of gross job flows in U.S. goods-producing industries (manufacturing, mining, construction) were different to those in service industries, with higher rates of job destruction and probable higher job reallocation. Mitchell *et al.* (2005) found similar results in Australia, with goods-producing exhibiting higher rates of job destruction than services. Job creation was found to be more persistent than job destruction, except in Goods-production after the

1990 recession. Mumford and Smith (2004) found that compared to Australian manufacturing employment growth, mining and accommodation showed higher growth; and electric/gas, wholesale trade and finance showed slower growth. Conversely, Armington and Acs (2004) found manufacturing and services behaved similarly in the US.

Similarly, the exchange rate literature has generally confined itself to studying employment dynamics in manufacturing industries. A few exceptions have found differential behaviour between the manufacturing and non-manufacturing sectors. Kletzer (2001) found job losses were concentrated in the service sector and in import-sensitive manufacturing. Goldberg *et al.* (1999) found that significant responses of US manufacturing and non-manufacturing industries to exchange rate changes worked in opposite directions. For example, in response to an import exchange rate appreciation, a job and/or industry change was less likely for manufacturing and more likely for non-manufacturing industries. While the probability of changing industries was found to be more sensitive than changing jobs.

Myers (2006) uses vector autoregression to analyse the responses of Australian manufacturing and non-manufacturing industries by external orientation to real exchange rate shocks. She finds that manufacturing experienced disproportionately higher and more volatile gross job flows. In turn, the increased volatility reflects the higher external exposure of manufacturing sector, where most of the industries are classified as importing and import-competing. Myers (2006) also finds that the good-producing sector experienced different gross job flow dynamics compared to the service sectors, with higher rates of job creation and destruction. It also experiences significantly positive short run job creation responses to an appreciation. Goods-producing and service groups exhibit lower rates of job creation after an appreciation in the longer term.

3. Job flows and openness in Australian industries

In this section we explore the extent to which gross job flows and the degree of openness vary across the different industry groupings noted above and within these groupings (see Myers, 2006 for a detailed description of the data).

3.1 The construction of gross job flow measures

The analysis in this paper is based on the widely used job creation rate (*JCR*) and job destruction rate (*JDR*) measures introduced by Davis and Haltiwanger (1990, 1992). Davis and Haltiwanger (1992: 827-8) calculate "gross job creation by summing the employment gains at expanding and new establishments within a sector. Similarly, we calculate gross job destruction by summing employment losses at shrinking and dying establishments within a sector." These job flows are converted to rates by dividing by sector size. We use 2- and 3-digit industry disaggregation reflecting data limitations for industries outside of manufacturing.

The size of industry *i* is defined as average employment in industry *i* at time *t* and *t*-1:

$$(1) \qquad \bar{E}_{it} = 0.5(E_{it} + E_{it-1})$$

where E_{it} is industry *i* employment at time *t*. Total employment in all sectors at time *t* is E_t.

Aggregations of the industry size variable yield:

(1a) $$E_{st} = \sum_{i \in s} \bar{E}_{it}$$

for sector-group size (summation of industry sizes comprising that sector) and

(1b) $$E_t = \sum_{i} \bar{E}_{it}$$

for overall size (the summation of all industry sizes which is equivalent to the aggregation of all sector sizes).

The rate of employment growth in sector *i* at time *t* (g_{it}) is defined as:

(2) $$g_{it} = \frac{E_{it} - E_{it-1}}{\bar{E}_{it}} = \frac{\Delta E_{it}}{\bar{E}_{it}}$$

Gross job creation and destruction rates over any subset of industries can be calculated from this growth rate. Thus for sector *s*:

(3) $$JCR_{st} = \sum_{i \in I} \left(\frac{\bar{E}_{it}}{\bar{E}_{st}} \right) g_{it} \qquad g_{it} > 0$$

$$JDR_{st} = \sum_{i \in I} \left(\frac{\bar{E}_{it}}{\bar{E}_{st}} \right) |g_{it}| \qquad g_{it} < 0$$

where I_s is the set of industries in sector *s*, and $\bar{E}_{st}$ is sector size. Aggregate gross job flow measures are then computed by summing over all sectors, weighted by the ratio of sector size to overall size (equivalent to summing over all industries, weighted by the ratio of industry size to overall size).

Total job reallocation rate is defined as:

(4) $$JRA_t = JCR_t + JDR_t$$

We also define net employment growth, NET_t as the difference between JCD_t and JDR_t.

3.2 Sectoral breakdowns

We generate gross job flow measures for three different sets of industry groupings:

1. Manufacturing industry group/Non-manufacturing;
2. Goods-producing (construction, mining, manufacturing); Trade-Services (wholesale and retail trade); and Remaining-Services (all remaining industries) (see Mitchell, Myers and Juniper, 2005; Ritter, 1994) (3-digit aggregation);
3. Exporting, importing, import-competing, traded and non-traded industry groups (2-digit aggregation).

In terms of the third decomposition, we follow Myers (2006) in using Input-Output data to categorise 2-digit industries into primary tradeable sectors. At present this analysis is experimental which explains why we do not present regression results based on this decomposition in this paper. The literature uses various definitions of openness (see for

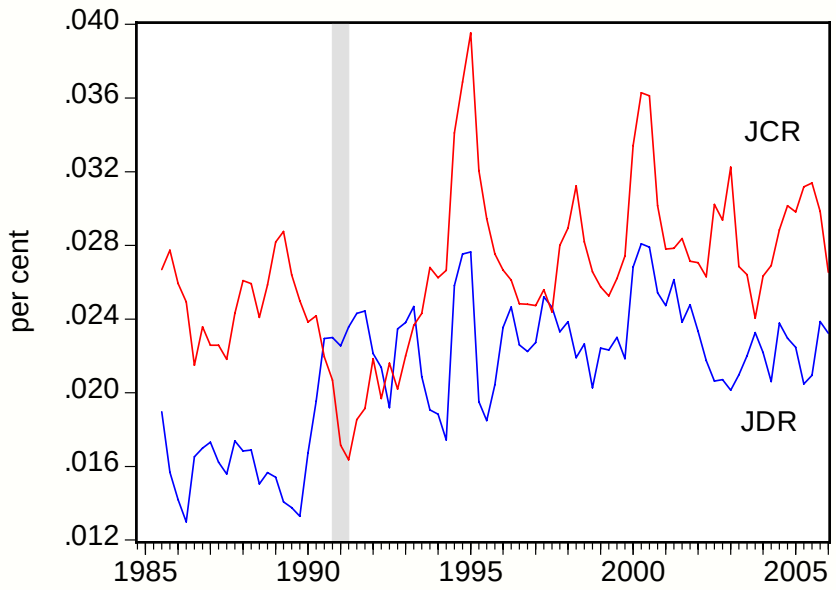
example Australian research by Dwyer and Groeger, 1994). We follow Myers (2006) and Gourinchas (1998) in apportioning employment within a classified industry and separating the traded and non-traded sectors with an excluded group. An industry is classified as export if its export share (exports/total supply) exceeds 12 per cent, while an importing industry has an import-penetration ratio (directly allocated competing and complementary imports/total supply) greater than 12 per cent. An import-competing industry has an import-penetration ratio (indirectly allocated competing imports/total supply) greater than 12 per cent. An industry may lie within multiple categories. A non-traded industry has either the combination of an export share less than 1.3 per cent and import penetration less than 6.8 per cent, or, an export share less than 5.8 per cent and an import penetration less than 0.8 per cent. Industries that are neither traded nor non-traded are classified as excluded (see Myers, 2006 for more detail). Gourinchas (1998) classified industries as tradeable only if tradeable in *all* the years of the sample. However, we follow Myers (2006) and employ complementary method of classification based on a single year's Input-Output data set (1998-9), allowing the same industries to be followed throughout and removing the problem of industry crossover or excessive loss of data (see also Dwyer and Groeger, 1994). The latest Input-Output data available is 2001-02, however the directly allocated import tables are still unavailable.

4. The behaviour of gross job flows in Australia

4.1 Overall gross job flows behaviour

Figure 2 shows the gross job flow rates for the overall non-farm sector from 1984:4 to 2006:1. The period up to the 1991 recession was marked by strong rates of job creation relative to the job destruction.

Figure 2 Gross job flow measures, All Industries, 1984:4 to 2006:1



Source: ABS6291.0 ST E06. All data is non-farm, seasonally adjusted at 3-digit level, three-quarter moving averages. Shaded area is December 1990 to June 1991 signifying the peak to trough of the 1991 recession.

The impact of the 1991 recession is clear and over the recovery period, the job creation rates have been higher and more volatile. Interestingly, job destruction rates have remained higher after the recession. On average, the job creation rate was 0.027 with a standard deviation of 0.006 while the rate of job destruction was 0.021 (standard deviation 0.005).

4.2 Manufacturing and non-manufacturing

Over the last 20 years the manufacturing industry has been in absolute decline and now accounts for around 11 per cent of total industry output (18.5 per cent in 1984). Table 1 shows that manufacturing rates of job creation and job destruction are sharply higher and twice as variable compared to non-manufacturing. Job creation rates in the non-manufacturing sector are also much higher than job destruction rates.

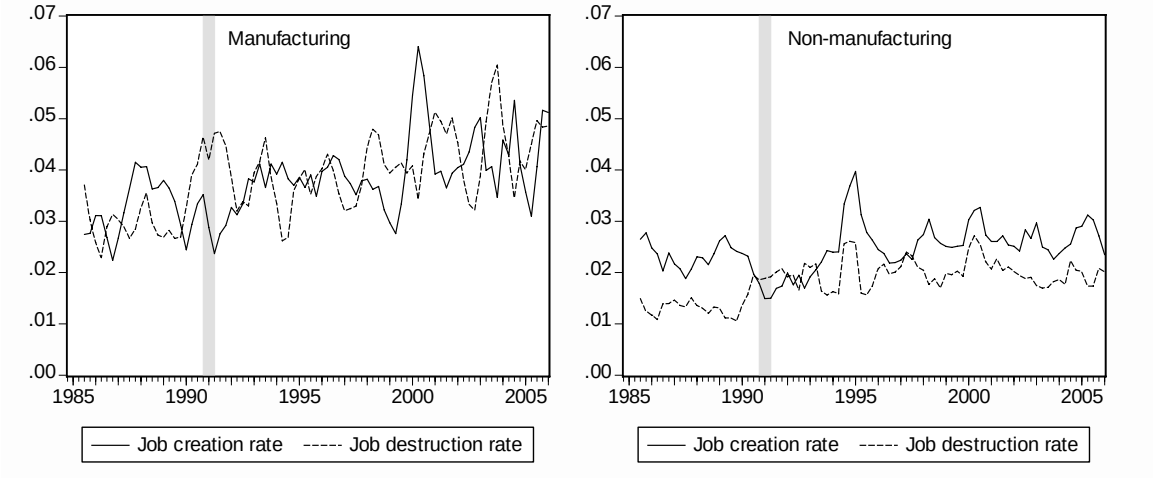
Table 1 Average job creation and destruction rates, Manufacturing and Non-manufacturing, 1985-2006

	JCR %	JDR %	Net employment change (000s)	Employment share % (Ave, Start, End)
Manufacturing	0.038 (0.011)	0.039 (0.011)	-0.9	14, 18, 11
Non-manufacturing	0.025 (0.006)	0.018 (0.006)	42.3	86, 82, 89

Note: standard deviations are shown in parentheses, 3-digit ANZSIC used.

Figure 3 shows the dynamic properties of the gross flows measures for Manufacturing and Non-manufacturing.

Figure 3 JCR and JDR for manufacturing and non-manufacturing industries, 1985-2006



Source: ABS6291.0 ST E06, 3-quarter moving average, unweighted. Shaded area is December 1990 to June 1991 signifying the peak to trough of the 1991 recession.

The manufacturing industries tend to be classified as traded industries. While the job creation and job destruction rates are of a similar magnitude in the manufacturing group,

non-manufacturing job creation rates tend to be greater than job destruction rates for all non-recession periods. The impact of the 1991 recession on manufacturing is apparent although job destruction rates were rising much earlier than the over GDP peak in December 1990. The evidence suggests that the gross job flows cycle tends to lead the GDP cycle.

4.3 Goods-producing, Trading-services and Remaining-services

Following Ritter (1994) and Mitchell, Myers and Juniper (2005) we define three broad industry groupings: Goods-producing industries (G); Trading-services industries (T); and Remaining-services industries (R). The sum of these sectors comprises All Industries discussed in Section 4.1. Table 2 shows the average job creation and destruction rates for the period between 1984:1 and 2006:2. The net employment change over the period has been positive for each grouping but proportionate shares have changed. The Goods-producing group (containing manufacturing) fell from around 27 per cent to 21 per cent of employment (average 23 per cent); the Trading-services group initially rose from 21 per cent to 22 per cent before falling to 20 per cent (average 21 per cent); while the Remaining-services group grew from 52 per cent to 59 per cent of estimated employment (average 55 per cent).

Consistent with Ritter (1994) who first proposed the three grouping classification, the Goods-producing group exhibits the highest rates of job destruction and job creation. On average, rates of job creation are greater than rates of job destruction for all groups. The Goods-producing and Trading-services sectors exhibit more volatile gross job flows than Remaining-services. These results compare with those of Borland (1996, Table 1) who confined his study to manufacturing and found that JCR was 0.023 and JDR was 0.043 (for the period 1978-79 to 1991-92). The higher rates of job destruction may reflect the fact that Borland's sample covered two major recessions whereas our sample includes only the 1991 recession. Our sample also covers the very long growth period following the 1991 recession, whereas the 1980s growth period was shorter in duration.

Table 2 Average job creation and destruction rates by 3-digit sector, 1984:1 to 2006:2

	JCR %	JDR %	Net employment change (000s)	Employment share % (Ave, Start, End)
Goods producing	0.034 (0.010)	0.032 (0.009)	4	23, 27, 21
Trading services	0.023 (0.009)	0.019 (0.009)	6	21, 21,20
Remaining services	0.025 (0.007)	0.018 (0.007)	29	55, 52, 59
All Industries	0.027 (0.006)	0.021 (0.005)		

Note: standard deviations are shown in parentheses.

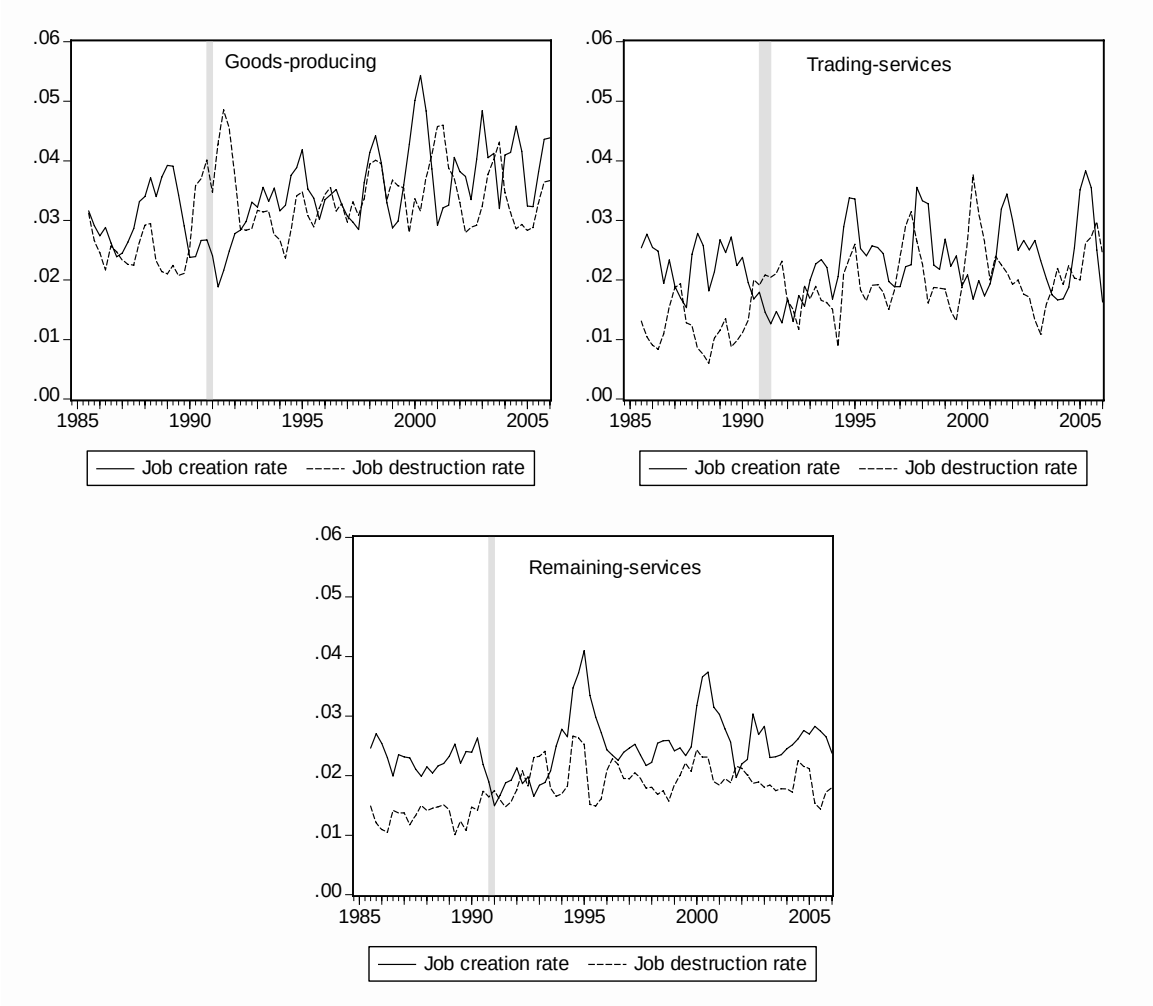
Gourinchas (1999) found that annual average job creation and job destruction rates in France between 1984 and 1992 were 14.22 per cent. For manufacturing, job creation was 11.5 per cent and job destruction was 13.59 per cent. Manufacturing employment declined by 2 per cent per annum over this period. Davis and Haltiwanger (1990) found

that US job creation rates in manufacturing were 9.1 per cent while job destruction rates were 10.3 per cent.

While not reported, we note that for all the industry-groupings, the 3-digit job creation rate measures are typically greater than their 2-digit counterparts. The difference lies in the fact that there are more 3-digit industries that can be either 'job creating' (non-zero job creation rates, zero job destruction rates) or 'job destroying' (zero job creation rates, non-zero job destruction rates) in a particular quarter.

The dynamic behaviour of the gross job flows in the broad industry sectors is also revealing (see Figure 4). Just prior to the 1991 recession, the Goods-producing sector reached job creation rates that took another decade to replicate. This sector saw a peak in job destruction rates and lower job creation rates during this recession, at rates which completely offset the growth of the previous years.

Figure 4 Gross job flows, Goods-producing, Trading-services, Remaining-services, 1985-2006



Source: ABS6291.0 ST E06, 3-quarter moving average. Shaded area is December 1990 to June 1991 signifying the peak to trough of the 1991 recession.

The rate at which Goods-producing jobs were created and destroyed remained higher than the other sectors throughout the recovery period. For Trading-services and Remaining-services, rates of job destruction remained at the higher level realised during the 1991 recession. While post-recession rate of job destruction for the Goods-producing sector also remained higher than pre-recession levels, they were generally not as high as the recession peak.

4.4 Job creation and job destruction – traded and non-traded.

In this section we report experimental gross job flow series based on the methodology outlined in Section 3. Table 3 shows that there were 17 Traded-goods industries, 8 Non-traded and 20 excluded industries. Within the Traded-goods sector, 14 were exporting, 8 were importing and 10 were import-competing (with some overlap between the categories where an industry undertook more than one trading activities). Overall, the Traded-goods sector declined in employment size over this period. Some of the decline within that sector was due to the absolute decline in manufacturing. Six of the fourteen 2-digit 'export' industries, seven of the eight Importing industries, and eight of the ten Import-competing industries were manufacturing.

Table 3 Average job creation and destruction rates by traded industry groups, 2-digit sector, 1984:1 to 2006:2

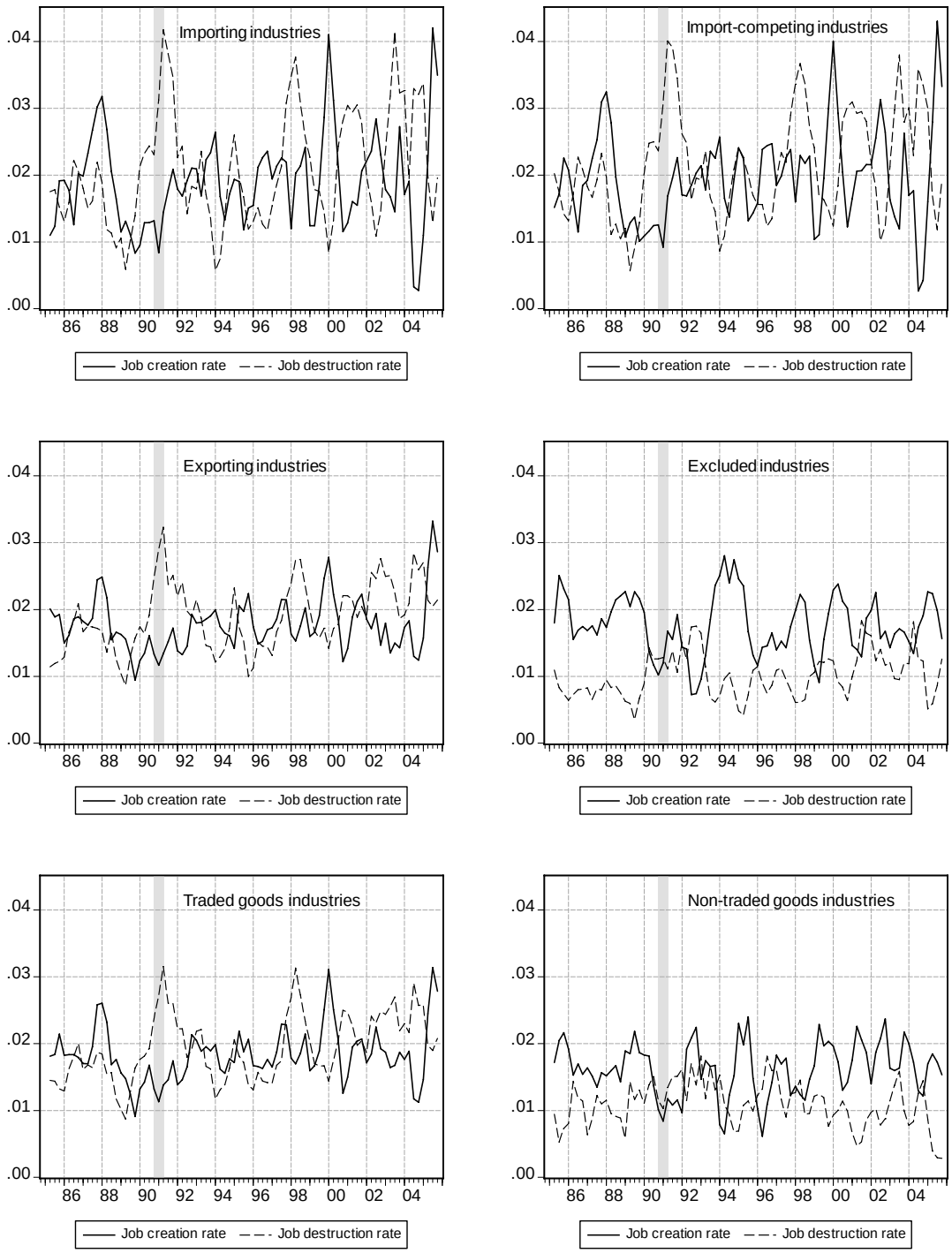
Group (2-digit)	JCR %	JDR %	Net Employment Change (000s)	Job share % (Start, End)
Exporting (14 industries)	0.018 (0.007)	0.019 (0.007)	-1.7	30 - 18%
Importing (8 industries)	0.019 (0.012)	0.021 (0.013)	-1.5	17 - 10%
Import-Competing (10 industries)	0.020 (0.012)	0.021 (0.011)	-1.7	19 - 11%
Traded (EX,IM,IC) (17 industries)	0.018 (0.007)	0.019 (0.007)	-1.9	34 - 21%
Non-traded (8 industries)	0.016 (0.007)	0.011 (0.006)	9.2	25 - 27%
Excluded (20 industries)	0.018 (0.007)	0.010 (0.005)	23.2	41 - 52%

Note: standard deviations are shown in parentheses. EX is exporting, IM is importing and IC is import-competing. The traded groupings were classified using 1998-9 input-output data.

Job creation and destruction rates are similar across the 3 sub-divisions on the Traded-goods sector and much higher than the Non-traded group. At the same time, the exporting sector has a lower volatility in its gross job flows. The gross job flow dynamics in the Traded industries are also quite different to the Non-traded and Excluded groups. Figure 5 shows that the rate at which Traded jobs are destroyed is almost twice that of Non-traded jobs on average over the period, with this gap widening towards the end of the period. Job destruction rates for all three Traded groups peak during the 1991 recession, with Traded job creation rates remaining at the low level reached in 1988-89 until the

recession trough. Non-traded job flow behaviour during the 1991 recession was far less marked.

Figure 5 Job creation and job destruction rates: Export, Import, Import-competing, Traded, Non-traded, Excluded industry groups, 1985 to 2006.



Source: ABS6291.0 ST E06, 2-digit ANZSIC, 3-quarter moving average. Shaded area is December 1990 to June 1991 signifying the peak to trough of the 1991 recession.

5. Model and regression analysis

5.1 The model

In this section, we estimate reduced-form relationships between gross job flows and real exchange rate fluctuations, controlled for factors such as aggregate domestic and international activity. Following Klein *et al.* (2003: 251-252) who note "that an appreciation in the exchange rate is associated with less job creation and greater job destruction … [other things constant and] … for two industries that are identical but for their respective values of openness … the effect of the exchange rate on both job creation and job destruction is more pronounced in the industry that is more open" we seek to test the following substantive hypotheses:

1. Job flows in the Traded-services and Remaining-services should exhibit minimal responsiveness to real exchange rate fluctuations.
2. Job flows in the Goods-producing sector should be sensitive to real exchange rate fluctuations such that an appreciation reallocates labour away from that sector. The empirical literature suggests that this reallocation will be dominated by job destruction rather than a decline in job creation rates.

Caballero and Hammour (1996) and the derivative model from Gourinchas (1999) provide a stylised way of representing the relationship between gross job flows and exchange rate movements which underpin these hypotheses. When the real exchange rate appreciates, employers in the traded-goods sector find it increasingly less profitable to hire new workers due to wage rises. The net reallocation of workers away from the traded-goods sector worsens unemployment. Further, as the appreciation approaches its peak, hires simultaneously accompany layoffs because it becomes easier to recruit from an expanding unemployment pool. In this model, job destruction responds strongly to real exchange rate fluctuations such that it peaks when the opportunity cost of reallocation is lowest (following an appreciation). Job creation is most profitable when unemployment is highest and this 'cleanses' the economy from the recession in the traded-goods sector. Accordingly, there is substantial within-sector reallocation close to the appreciation peak. As the depreciation begins, all workers benefit as wages rise in the face of rising labour demand and old vintages of capital are scrapped. Gourinchas (1999: 1294) says "net exit occurs mostly during the appreciation phase and is largely driven by job destruction, with job creation playing a more passive role. Destruction increases as the opportunity cost of reallocating workers falls. This creates a large pool of unemployed workers willing to find a job in the traded sector. In turn, this plants the seed for the subsequent increase in hiring."

The chosen reduced-form specification is:

$$(5) \qquad JF_{it} = \alpha_i + \beta(L) r_{it} + \delta(L) X_t + \varepsilon_{it}$$

where JF_{it} are job flows (either job creation or job destruction or job reallocation rates) in industry group *i*, r is the de-trended industry-specific real exchange rate, and *X* is a matrix of variables that reflect aggregate domestic and other international impacts, which may influence both the gross job flows but also the real exchange rate. We specifically include foreign GDP growth (proxied by the growth in the US economy), the domestic

investment to GDP ratio, total non-farm employment growth, the spread between long-term and short-term interest rates.

In estimating a reduced form relationship between gross job flows and exchange rate changes we encounter the problem that neither nominal nor real exchange rates are exogenous. Some aspects of nominal exchange rate movements may reflect domestic or foreign aggregate policy changes (particularly monetary policy) (see Gourinchas, 1998). Domestic monetary policy settings may react to exchange rate outcomes although in Australia since the early 1990s this is less likely.

Gourinchas (1998: 4) noting the considerable uncertainty in the literature concerning exchange rate determination opts for a deterministic trend to separate out the two components and thus create an exogenous real exchange rate variable (the de-trended component). Klein *et al*. (2003) use a quadratic trend to accomplish the same decomposition. Klein *et al*. (2003: 254) suggest that the trended component can be considered "that part of exchange rates that agents view as permanent … It is reasonable to expect an asymmetry between the responsiveness of job creation and job destruction to *cyclical* changes in the exchange rate." We follow the Klein *et al.*, (2003) approach here. The deterministically (quadratically) de-trended exchange rate is mostly driven by cyclical movements that are considered by construction to be transitory. With no clear guidance on what is the most appropriate measure of the real exchange rate we experiment with three measures available from the RBA: (a) export-weighted; (b) import-weighted; and (c) G7 GDP weighted. We use the log of the de-trended real exchange rate in our regressions, irrespective of which real exchange rate measure is chosen.

To ensure that the exchange rate fluctuations are not mimicking aggregate factors we include national Non-Farm Employment growth (empg) taken from ABS Labour Force statistics; the term-spread between the 15 year treasury bond less the average money market rate (which approximated the 13 week treasury bill) from the IMF International Financial Statistics (s1); and a measure of external economic activity (the US GDP growth rate) taken from OECD Main Economic Indicators.

5.2 Results

We began with a general specification (2 lags on each of the explanatory variables). This level of generality was sufficient to generate well-behaved residuals. We then tested down to the most parsimonious specification using standard *F*-test procedures. All the final forms were acceptable reductions on the general models. The results are presented in Tables 4 and 5. The reported real exchange rate weighting was that which produced the highest level of statistical significance. For job creation, the Goods-producing equation was re-estimated using ARCH(1) estimation (there were leverage issues in the dataset due to data redefinitions) and the resulting equation is reported. The RESET specification test and the serial correlation tests for the initial OLS estimation were satisfactory.

The other equations reported were estimated using OLS. For the Goods-producing equation, a first-difference restriction on the real exchange rate was suggested (coefficient on current and lagged value of equal and opposite signs) and subsequent reparameterisation proved to be a valid simplification. For the other models, there was no statistical significance revealed in either the current or the lagged value and we report the

equations in that form, even though deleting the real exchange rate variable would produce valid simplifications.

Table 4 Job creation rates, Goods-producing, Traded-services, Remaining-services

	Goods producing	Traded services	Remaining services
Real exchange rate	0.060 (3.60)[a]	-0.018 (0.84)[b]	-0.015 (1.13)[b]
Real exchange rate (-1)	-0.053 (3.31)	0.013 (0.63)	0.016 (1.19)
Employment growth	0.004 (3.95)	0.007 (3.96)	0.005 (4.77)
Interest spread	0.002 (5.55)	0.001 (1.70)	0.001 (1.78)
GDPG_US (-2)	0.443 (3.11)		
R^2	0.31	0.35	0.512
SC p-value $\chi^2(2)$	n/a	0.876	0.736
ARCH p-value $\chi^2(1)$	0.085	0.06	0.820
RESET p-value $\chi^2(2)$	n/a	0.439	0.852
Observations	84	84	84
Sample	1985:2 to 2006:1	1985:2 to 2006:1	1985:2 to 2006:1

Notes: The Goods-producing equation was estimated using ARCH(1) while the other two models were estimated using OLS; *t*-statistics are reported in parentheses; constant used but not shown. SC is a test for second-order serial correlation. (a) The export-weighted real exchange rate was used. (b) The G7 GDP-weighted real exchange rate was used. Some dummy variables were used to accommodate issues with definition changes in the data.

The final Goods-producing simplification (estimated using ARCH(1) and with the first-difference restriction imposed on the real exchange rate) yielded:

$$JCR\_G_t = \underset{(18.5)}{0.026} + \underset{(3.60)}{0.060}\,\Delta rer_{t-1} + \underset{(3.95)}{0.004}\,empg_t + \underset{(5.54)}{0.002}\,spread_t + \underset{(3.11)}{0.458}\,GDPG\_US(-2)$$

$$R^2 = 0.314$$

$$\text{ARCH: } \chi^2(1) = 0.084$$

Accordingly, the job creation rate in the Goods-producing sector is positively influenced by the change in the real exchange rate. So the faster the real exchange rate appreciates, the higher is the job creation rate in the Goods-producing sector.

National employment growth impacts predictably on all three industry groupings. Measures of real unit labour costs were included initially without success. The interest rate spread impacts significantly only on the Goods-producing sector which suggests that it is via this channel that monetary policy operates on job creation. More study is needed of this result. Further, world growth (proxied via the US GDP growth rate) impacts with a lag on the Goods-producing industries only, reflecting their higher degree of openness. Again, we tentatively conclude that external shocks enter the economy via these industries (principally through agriculture, mining and manufacturing).

Table 5 reports the results for the corresponding rate of job destruction regressions. The export-weighted real exchange rate generated the best results for all three industry sectors. All regressions satisfy the usual diagnostic tests.

Table 5 Job destruction rates, Goods-producing, Traded-services, Remaining-services

	Goods producing	Traded services	Remaining services
Real Exchange rate	0.047 (2.04)	-0.037 (1.66)	0.007 (0.70)
Real exchange rate (-1)	-0.067 (2.19)	0.039 (1.77)	-0.012 (1.17)
Real exchange rate (-2)	0.044 (2.05)		
Employment Growth	-0.004 (2.36)	-0.006 (3.21)	-0.005 (5.58)
Interest Spread	0.001 (2.01)	0.001 (1.70)	0.001 (3.90)
GDPG_US		0.337 (1.83)	
GDPG_US (-2)	0.340 (1.81)		0.230 (2.73)
R^2	0.37	0.27	0.64
SC p-value $\chi^2(2)$	0.721	0.115	0.629
ARCH p-value $\chi^2(1)$	0.264	0.421	0.944
RESET p-value $\chi^2(2)$	0.782	0.379	0.051
obs	83	85	83
Sample	1985:3 to 2006:1	1985:1 to 2006:1	1985:3 to 2006:1

Notes: All equations were estimated using OLS; *t*-statistics are reported in parentheses; constant used but not shown. SC is a test for second-order serial correlation. The export-weighted real exchange rate was used throughout. Some dummy variables were used to accommodate issues with definition changes in the data.

The real exchange rate impact is statistically significant (at the 5 per cent or better level) for only the Goods-producing sector, although it is significant at the 10 per cent for Trading services. For the Goods-producing equation, a first-difference restriction on the real exchange rate is again suggested (coefficient on current and lagged value of equal and opposite signs) and subsequent reparameterisation proved to be a valid simplification. Once again we could further simplify the Trading-services and Remaining-services equations by omitting the statistically insignificant real exchange rate variables.

The final Goods-producing simplification with the first-difference restriction imposed on the real exchange rate yielded:

$$JDR\_G_t = \underset{(22.1)}{0.035} + \underset{(2.09)}{0.048}\Delta rer_t + \underset{(2.28)}{0.027}\, rer_{t-2} - \underset{(2.28)}{0.004}\, empg_t + \underset{(2.03)}{0.001}\, spread_t + \underset{(1.91)}{0.359}\, GDPG\_US(-2)$$

$$R^2 = 0.361$$

SC: $\chi^2(2) = 0.733$ ARCH: $\chi^2(1) = 0.224$ RESET: $\chi^2(2) = 0.722$

Accordingly, the job destruction rate in the Goods-producing sector is positively influenced by the current change in the real exchange rate and the level that the real exchange rate stood at two quarters ago. So the faster the real exchange rate appreciates and the higher level it stood at two quarters ago, the higher is the rate of job destruction in the Goods-producing sector.

National employment growth impacts predictably on all three industry groupings. When national employment growth slows, job destruction rates rise. Again, measures of real unit labour costs failed to show any statistical significance. The impact of the interest rate spread is now more general although it now suggests that an easing of monetary policy increases job destruction rates (as well as job creation). This suggests that a more lax monetary policy stance encourages greater resource flows between industries. Again, more study is needed of this result. The impact of world growth is also broader and suggests that more buoyant international conditions promote higher rates of job destruction in Australian industry, perhaps as resource flows chase opportunities outside our national economy.

6. Conclusion

In this paper we have examined the impact of the real exchange rate on gross employment flows in the Australian labour market. As an introduction to a wider study we studied rates of job creation and job destruction in three broad industry groupings described in Mitchell, Myers and Juniper (2005): Goods-producing, Traded-services and Remaining-Services. The Goods-producing sector is exposed to external influences more heavily than the other two sectors, although Traded-services is cyclically-related to the Goods-producing industries. We find that real exchange rate changes do increase job reallocation in the Goods-producing sector impacting similarly on both job creation and job destruction. We do not find evidence that the reallocations that are driven by real exchange rate changes are dominated by job destruction. We also find that the services

industry groupings are not directly sensitive to real exchange rate fluctuations which would accord with the findings from other studies outside of Australia.

Experimental analysis in Section 4 suggests that gross job flows are very different in the Traded-goods sector compared to the Non-traded goods sector. Once we are confident that the job flow measures for the traded (export, import, import-competing) and non-traded classification have integrity we will investigate their responsiveness to real exchange rate fluctuations at the 4-digit level with more refined real exchange rate series.

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