Labor Market Transmission of Macro Shocks:  

Firm-Level Evidence from Indonesia

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Short Abstract

Abstract: How do aggregate shocks reverberate through the labor market? This paper uses the Indonesian manufacturing census (1990-2007) to examine how firms were impacted by the East Asian Crisis, focusing on tradeoffs between adjusting on wages (“price adjustment”) and employment (“quantity adjustment”) controlling for selection bias due to firm exit. Our exploratory analysis indicates that manufacturing firms adjusted primarily through reducing real wages, rather than through widespread job losses. White-collar workers were especially severely affected. However, there was high heterogeneity in how firms coped with the shock; large firms adjusted more on employment than small firms and firms paying higher wages, had the lowest employment losses. Ongoing work examines the determinants of firm vulnerability in more depth drawing on recent panel data methods such as Systems GMM to examine for which firms adjusting on wages and employment are substitute strategies and for which firms these are complementary coping strategies.
Detailed Outline

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1 Introduction

How do large aggregate shocks reverberate through the labor market? What determines how firms cope with shocks and whether they cut employment (“quantity” adjustment), slash wages (“price adjustment”) or exit altogether? This paper attempts to answer these questions by studying the impact of the East Asian crisis on firm dynamics in Indonesia, using the Indonesian manufacturing census, a unique firm-level dataset containing detailed information on wages, employment and output, that enables us to examine various dimensions of adjustment. We focus on the impact of the crisis on firm’s labour demand and wage-setting behaviour.

The paper aims to contribute to the literature in a number of ways. To start with, while there is a large literature on how households cope with crisis, the existing empirical evidence on the impact of extreme economic events on firm dynamics is scarce. This is surprising since understanding how crises affect the demand for labor at the micro-level requires firm-level data. Secondly, a burgeoning literature on reallocation dynamics suggests strong asymmetries in job creation and destruction over the business cycle and high heterogeneity in job flows both across and within sectors. It is not clear how these findings generalize to crisis times, when fluctuations in economic conditions are more extreme. Thirdly, by documenting heterogeneity in adjustment patterns we examine which firms were most impacted and what the crucial determinants of firm vulnerability were. For example, we assess whether or not firms that exported and firms more dependent on external credit were hit especially hard. In addition, we assess whether the gender composition of the workforce matters. Fourthly, by jointly examining the impact of crises on wage and employment adjustment, we can test whether the tradeoff between price and quantity adjustment observed using aggregated data (see e.g. Fallon and Lucas (2002)) is driven by differences in adjustment within firms or whether this is a between firm phenomenon. In addition, we examine whether or not employment and wage responses to shocks are asymmetric and whether or not such
asymmetries were exacerbated by the crisis. We also assess how minimum wage legislation mediated the impact of the crisis and subsequent recovery.

Understanding how shocks are transmitted through the labor market since the labor market is a prime transmission channel of macro-shocks to household welfare. Moreover, in the aftermath of crisis aggregate indicators such as the recovery of GDP often obscure protracted pain in the labor market. In addition, even short-lived labor market shocks can have lasting adverse effects that may jeopardize long-run growth. How labor markets adjust matters for policymakers, since they will face tradeoffs between protecting those most impacted and those most vulnerable and have to tackle potential tradeoffs between minimizing short-term job losses as well as declines in earnings and catalyzing long-term growth. These concerns are often especially relevant in developing countries, as they are more vulnerable to volatility and because labor income is often the most important, if not the only, source of income for a large share of the population.

The performance of the Indonesian manufacturing sector during the East Asian crisis provides a very relevant context to examine the transmission of macro shocks to labour market outcomes in a developing country. The crises serves as a “natural” experiment that enable us to assess the impact of extreme economic duress on firm dynamics. While the manufacturing sector only accounts for a small share of total employment, it is a sector of interest in and of itself since manufacturing workers are typically paid relatively high wages. In addition, strong manufacturing performance had been an important driver of growth until the onset of the crisis and manufacturing was one of the hardest hit sectors. Moreover, the size sheer and archipelago geography of Indonesia sustain a multitude of manufacturing activities in a variety of institutional settings, providing us with cross-sectional and temporal variation which we can exploit in our econometric strategy. In addition, Indonesia has a uniquely rich longitudinal census of manufacturing firms.

The remainder of this outline is organized in bullet points. The next sections briefly reviews related literature. Section 3 discusses the data and documents stylized facts. Section four presents our estimation strategy and some highly preliminary findings, while a final section concludes.

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1 The labor income share typically drops permanently during recessions. In addition, workers that graduate during a recession face an earnings penalty that only gradually declines over time, while those who are laid off face lasting reduced employment effects. Moreover, a large literature shows on household coping strategies suggest that income shocks can have lasting negative effects on human capital accumulation.
2 A Review of Related Literature

At the macro-level there appears to be a tradeoff between wage adjustment and employment losses in response to crises. Lucas and Fallon (2002) point out that during the East Asian crises those countries with the lowest declines in average real wages, faced the most severe employment losses. Though the impact of crises on open unemployment is often muted, aggregate statistics hide substantial sectoral churning and re-allocation of labor. Recent financial crises have rapidly spread from initially affected sectors, typically urban-based exporters, construction and manufacturing, to other parts of the economy, via reduced demand and re-allocation of labor. ² Using information on sectoral employment flows, Gallego and Tesseda examine the impact of sudden stop crises on job flows in Latin American and find sudden stop crises are associated with lower rates of job creation and higher rates of job destruction. Sectors with higher rates of dependence on external credit have lower creation rates, while those more dependent on liquidity have higher destruction rates. In addition, they find a negative correlation between firing and dismissal regulations and destruction rates.

Their paper contributes to a burgeoning literature on the determinants of re-allocation and industry dynamics (surveyed in Bartelsman and Doms, 2000 and Caves, 1998) which demonstrates that the business cycle is an important determinant of both the pace and pattern of reallocation (see e.g. Bartelsman and Haltiwanger, 2001). Job creation and destruction behave asymmetrically over the business cycle as job creation is highly countercyclical (Davis et al, 2001). Yet, even during downturns, there are still a lot of firms that expand employment. In addition, labor productivity is procyclical, suggesting a large penalty associated with downsizing (Bartelsman XXX). However, it is not clear to what extent these findings generalize to times of extreme economic uncertainty and what the impact on crisis on wage dynamics is as papers on firm dynamics in crisis times is relatively largely scarce.

Focussing specifically on crisis periods.

- Ouyang (2009) argues that crisis reduce firm-learning

² Thus even those sectors not immediately impacted by a crisis are likely to suffer substantial losses. For example, increased entry into agriculture and informal firms erodes the profitability of such sectors. In Indonesia, for example, while the construction sector initially bore the brunt of the impact from the 1998 crisis, contracting by 37%, by the end of the crisis mean earnings across the economy had declined by an estimated 40%, with falls distributed over the entire income-earning distribution (Manning 2000)
Barlevy (2002) argues that crises exacerbate labor market imperfections by increasing frictions and search costs. Indeed, job creation is procyclical; jobs created in recessions are temporary and low-paid;

- Gorg and Alvarzes find that multinationals serve as stabilizers and are typically less affected by crises (Gorg and Alvarez, 2006)

- Literature on asymmetric adjustment costs: (see e.g Hammermesh and Pfann (1996))
  - Few papers examine impact on both wages and employment. A notable exception is (Holzer and Montgommery, 1992) who demonstrate that firms adjust wages asymmetrically in response to shocks, but not employment.
  - However, they fail to control for selection bias (due to exit) and unobserved heterogeneity (e.g. fixed effects).
  - Wage rigidities; Large lit on lm distortions due to min wages, yet relatively little evidence on their impact in crises

3 Data and descriptive statistics

3.1 Data

The Indonesian Manufacturing Census (1990-2006) provides the empirical basis for our analysis. It is uniquely well-suited for a detailed examination of the impact of the East Asian crisis on firm behavior since it contains information on all Indonesian manufacturing firms with more than 20 employees and spans the pre- and post- crisis periods, as well as the crisis itself. Moreover, it contains very detailed information on employment, wages, output, industrial classification, exporting and importing, electricity usage and ownership. A drawback of the data is that they are rather noisy and that it does not contain information on the very smallest firms; consequently, we cannot discriminate between true exit and falling below the 20 person size threshold.

To examine how dynamics differ across sectors, we augment the data with Rajan-Zingales measures of financial dependence, turnover, the natural rate of entry and other salient sectoral characteristics. In addition, we complement the survey with information on minimum wages to examine whether variation in minimum wages is associated with different patterns of employment adjustment. We also intend to complement our dataset with provincial level information on local
labor market characteristics and local economic performance (e.g. provincial GDP, composition of employment, unemployment rates etc.).

### 3.2 Descriptive Statistics

Our exploratory investigation yields some interesting stylized facts.

- **Manufacturing firms adjusted primarily through a reduction of wages, especially for non-production workers, rather than widespread job losses.**
  - on average, employment only declined by 3.1%, while real wages for production workers fell by 20% and average real wages for non-production workers fell by 29%.
  - However, almost half the firms reduced employment
- **However; the labor and wage adjustment of firms was marked by high heterogeneity:** some firms grow quickly even during the crisis:
  - **Labour Adjustment**
    - **Large firms adjust more on employment than small firms**
      - this result is only partly driven by the fact that our variable for employment growth is truncated.
      - Interestingly, while large firms had the highest rates of employment destruction, they also had the highest rates of employment creation during the crisis (though the average employment creation effect is negative)
    - **Firms paying high wages had the lowest employment losses on average,** yet also exhibited high variance in employment growth; the gross destruction rates in this group were on a par with those of firms paying lower wages; yet the gross job creation was much larger than that of firms paying lower wages. The lower average net employment losses are thus driven by the fact that a number of firms continued to grow.
  - **Impact of exporting, financial dependence and share of women are not monotonic**
    - Gender-balanced firms on average had lower employment losses
- Firms with a high proportion women have the highest destruction rates.
  - Export oriented firms have both higher creation and higher destruction; i.e. they are more volatile
- Firms which export continued to exhibit higher employment growth during the crisis period

### Wage Adjustment
- Firms with the lowest wages had the highest wage growth (cut wages the least) both during the crisis and less volatile times presumably because they have less scope for adjustment
- Larger firms have higher wage growth
- The higher the share of women, the less wages were cut during the crisis (presumably because women get paid less already)
- Exporters exhibited higher wage growth
4 Econometric Strategy

4.1 Econometric Framework

**Summary:** We will use reduced form autoregressive distributed lag models and combine those with a Rajan Zingales approach to test for the impact of the crisis.

**Theories of labor demand** typically suggest that labor demand \( L_d = L(W, Y, X) \), where \( W \) is the wage rate (which may be a choice variable), \( Y \) is the firm’s output and \( X \) is a vector of firm, industry and province characteristics that may affect the firm’s demand for labor.

**Econometric Framework:** Our point of departure is the first-degree general distributed lag model:

\[
L_{it} = \beta_{L1}L_{it-1} + \beta_{Y1}Y_{it-1} + \beta_{W1}W_{it-1} + \beta_{w0}W_{it} + \beta_{X1}X_{it-1} + \beta_{X0}X_{it} + \beta_0C + \epsilon_{it}
\]

Where \( L_{it} \) is current firm size, \( W_{it} \) is a vector of wages, \( Y_{it} \) is output (or possibly value-added per worker) and \( X_{it} \) is a vector of time-varying firm characteristics (see below) and \( C_{it} \) is a vector of time-invariant firm characteristics. The explanatory variables \( X_{it} \) include controls for firm characteristics, including its age (and its square), characteristics of the workforce (possibly TFP – in which case we may wish to drop \( Y_{it} \)), industry characteristics \( IND \), and measures of local policies, \( POL \) (see the Appendix).

This modeling has a number of appealing features:
• **Short-vs Long-run elasticities** This formulation enables us to identify both short-run and long-run elasticities. Consider elasticity of labour with respect to wage changes, which is \( \beta_{W0} \) in the short run and \( \frac{\beta_{W1} + \beta_{W0}}{1 - \beta_{L1}} \) on the longer run.³

• **Encompassing** As pointed out by Hendry (1995) this specification nests a host of more restrictive models. For example, if \( \beta_{w1} = \beta_{Y1} = \beta_{X1} = 0 \), the model is a partial adjustment model. If \( \beta_{w1} = \beta_{Y1} = \beta_{X1} = \beta_{L1} = 0 \), the model is a static adjustment model (e.g adjustment is instantaneous). If \( \beta_{Y0} = \beta_{Y1}, \beta_{X0} = \beta_{X1} \) and \( \beta_{W0} = \beta_{W1} \) and \( \beta_{L1} = 0 \), the model is a fixed effects model. Moreover, if the lag-length is 1, the model is also consistent with dynamic optimization under quadratic adjustment cost (see e.g. Nickell, 1986).

In addition, we can tweak the model to allow for

• **Asymmetric adjustment to positive and negative shocks.** Allowing for symmetric shocks can be achieved by estimating the above model in differences and distinguishing between positive and negative changes in real output. Alternatively, we can reparameterize the model and write it as a function of first differences and lagged levels (this will be our preferred specification): **note this is an error correction specification.**

\[
\Delta L_{it} = \beta_{L1} L_{it-1} + \beta_{\Delta Y} \Delta Y_{it} + \beta_{Y1} Y_{it-1} + \beta_{\Delta W} \Delta W_{it-1} + \beta_{w1} W_{it-1} + \beta_{\Delta X1} \Delta X_{it} + \beta_{X1} X_{it-1} + \beta_{\Delta C} \Delta C + \varepsilon_{it}
\]

NB note that this reparameterization is convenience as it helps us differentiate between differences in employment growth associated with changes in observable characteristics and “initial” observable characteristics.

³ To see this note that, to have a stationary (steady-state) equilibrium, it is necessary to assume that \( \beta_{L0} < 1 \), for if it is not, firms will continue to grow forever and asymptotically firm-size would tend to infinity. Assuming \( \beta_{L0} < 1 \) and that all the other variables are constant, we obtain

\[
L_{i}^{*} = \frac{1}{1 - \beta_{L1}} [(\beta_{f1} + \beta_{X0})Y^{*} + (\beta_{x1} + \beta_{X0})X^{*} + (\beta_{w1} + \beta_{W0})W^{*} + \beta_{C} C]
\]

The “long-run” elasticity with respect to wages is thus: \( \frac{\beta_{W1} + \beta_{W0}}{1 - \beta_{L1}} \), while the short-run elasticity is \( \beta_{W0} \). Also note that this specification only enables us to identify “levels” effects; i.e. changes in explanatory variables are not allowed to permanently alter the growth rate of labour.
• **Selection bias:** We will use a simple Heckman selection correction model to correct for selection bias. This amounts to augmenting the labour growth equation with a selection correction term.
  
  • *Candidate exclusion restrictions:* though it is very difficult to think of variables that affect the decision to exit but not employment adjustment, the literature has used proxies for the minimum efficient scale of production, market power and foreign ownership as exclusion restrictions.
  
  • We follow the literature and use Minimum Efficient Scale of production proxied by median firm-size as an instrument

• **Testing for the impact of the crisis.** We can extend this model to examine the impact of the crisis on firm behavior by interacting crisis dummies with explanatory variables. Suppose for example that we wish to examine whether the impact of access to finance is different during crisis; then we can estimate:

\[
\Delta L_{it} = \beta_{L1} L_{it-1} + \beta_{\Delta Y} \Delta Y_{it} + \beta_{Y1} Y_{it-1} + \beta_{\Delta w} \Delta W_{it-1} + \beta_{w1} W_{it-1} \\
+ \beta_{\Delta X1} \Delta X_{it} + \beta_{X1} X_{it-1} C + \beta_{\text{Cris}*C} \text{CRISIS} + \beta_{\text{Cris}} \text{CRISIS} + \varepsilon_{it}
\]

Under the null hypothesis, the crisis does not have a special impact on adjustment, while the crisis does have a special impact if \( \beta_{\text{Cris}*C} \neq 0 \). (Note this approach is inspired by Rajan and Zingales).

**Wage Equations:**

Wage equations are set up analogously using the same set of explanatory variables – thus “implicitly” estimating a system of equations (Christev and Fitzroy, 2002)

E.g. our estimating equation becomes:

\[
\Delta W_{it} = \gamma_{W1} W_{it-1} + \gamma_{\Delta Y} \Delta Y_{it} + \beta_{Y1} Y_{it-1} + \gamma_{\Delta w} \Delta W_{it-1} + \gamma_{w1} W_{it-1} \\
+ \gamma_{\Delta X1} \Delta X_{it} + \gamma_{X1} X_{it-1} C + \gamma_{\text{Cris}*C} \text{CRISIS} + \gamma_{\text{Cris}} \text{CRISIS} + \varepsilon_{it}
\]

5 Results
5.1 Estimation issues

- Endogeneity of explanatory variables e.g. wages (and output/productivity, minimum wages) in the employment regressions and employment (and output/productivity, minimum wages) in the wage regressions: we can attempt to instrument wages using the local unemployment rate (or – and presumably less convincing – industry-province specific wage rates). Alternatively, we can use lagged wage rates. The preferred solution, however, will be to use lagged dependent variables.

- Serial correlation: it is likely that the error terms are serially correlated. We will attempt to tackle this by using fixed effects methods and GMM – using lagged values of explanatory variables as instruments for themselves. In this context, it should be noted that Difference GMM may be preferred to Systems GMM since the latter requires mean stationarity of the residuals, which may be too restrictive an assumption for the present purposes.
Appendix A: Explanatory Variables

The vector $X_{it}$ contains a number of firm, industry and province-level characteristics. Candidate explanatory variables include:

$E_{it}$ = a vector of firm characteristics: i.e.
- the capital stock (and its square)
- firmage and its square
- ownership
- the share of women
- share of production workers vs non-production workers
- Export data

$IND_{it}$ = a vector of industry characteristics: i.e.
- Dependence on credit (Rajan-Zingales)
- Natural rate of turnover (Rajan-Zingales)
- Natural rate of entry (Rajan-Zingales)
- Competitiveness: Herfindahl (normalized)
- [optional] Minimum efficient scale (possibly proxied by median firm-size)
- industry wage
- [optional] provincial.industry wage (average wage of other firms in the same industry/province)

$POL_{it}$ = a vector of policies; in our case: minimum wages (& minimum wage changes)

$YEAR_t$ = vector of year dummies

$PROV$ = vector of province dummies