

# An Investigation into the Effect of Capital Flow Liberalization on Wages

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## Introduction

Over the past 30 years, wage dispersion in the US has increased significantly. One potential culprit for this increased dispersion is the growth in trade, and a considerable economic literature has arisen to study this possible link. Most economists have come to the conclusion that increased trade can not have played a major role in the deterioration of the wage distribution. A leading argument behind this conclusion is that with competitive factor markets, all factor price changes must be accompanied by output price changes. From this argument it follows that, since the terms of trade of the United States in the last 30 years have been remarkably stable, it seems unlikely that trade is primarily responsible for the observed increase in wage dispersion.

As an empirical statement, however, there is a problem with this argument. It relies upon the assumption of competitive factor markets. But when wages are determined non-competitively through bargaining between unions and firms, an increase in trade possibilities (either through a reduction in tariffs or through a reduction in transportation costs) can lead to a large change in wages without a large change in prices. Trade liberalizations can weaken worker bargaining power because they can increase the ability of firms to threaten to relocate to other countries and import the produced final goods.

A potentially even more important, and vastly understudied, channel for the threat effect is the global increase in capital mobility. Over the past 30 years, capital market mobility has increased dramatically. During the period 1970 to 1995, global

foreign direct investment increased from 0.3% of World GDP to 1.4%<sup>1</sup> (See Figure 1)-- more than a fourfold increase. Our aim in this paper is to try to ascertain the effect of capital market liberalization upon wages. In particular, we will explore whether the changes in wages after a capital market liberalization can be attributed entirely to changes in the level of the capital stock and prices (of output and capital), or whether there is a separate effect of capital market liberalization upon wages. If capital market liberalization has a significant negative effect on wages, then the worldwide trend toward higher levels of capital market integration could potentially be one of the most important factors explaining the global deterioration in wages of low wage workers. To date, there has not been a great deal of research in this area; we hope that our results will illustrate the need for further research.

As a stepping-stone to gauging the extent of the effect of capital market liberalization on wages, it is useful first to discuss the differences between neoclassical and bargaining-based theories of wage determination.

## I. Neoclassical Theories of Wage Determination

### *Bargaining and the Threat Effect*

In this section, we will explore the manner in which capital market liberalization may affect wages by examining how wages are determined by the labor, product and capital markets (the three most important markets) under both competitive and non-competitive conditions. Specifically, we will consider, first, the case of perfect competition in all three markets; second, the effect of imperfections in the product

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<sup>1</sup> Source: World Bank, World Development Indicators, CD-ROM.

market; third, the effect of imperfections in the capital market; and fourth, the effect of imperfections in the labor market.

If we assume that all markets are competitive, capital-market liberalizations can lead to rises or falls in wages. Capital rich countries, where the return to capital is relatively low because the supply is relatively high, will experience a deterioration of wages as capital leaves for capital-poor destinations. The opposite will of course, be true for capital-poor countries, due to the decrease in the marginal product of labor resulting from capital flight. In fact, countries will experience wage declines if and only if other countries experiences a relative rise in wages. Capital market liberalizations are very similar to trade market liberalizations. Wages are determined by in-country marginal-products. Therefore, to the degree that wages fall or rise in a given country, it is due to the marginal product of labor falling or rising. The marginal product of labor, however, only falls and rises through changes in the level of the capital stock. So, to the degree that rich country workers are hurt by capital outflows leading to lower marginal products, poor country workers are aided by the resulting capital inflows.

Thus, the neo-classical theory of capital market liberalizations predicts that developing country unions would support multilateral capital market liberalizations. This, however is counter-factual. Is the analysis of unions misguided or are there substantiated fears for losses in real wages as a result of capital market liberalization? Certainly, if labor markets are competitive, capital markets are competitive, and goods markets are competitive, then there is no reason for unions in capital-poor countries to be concerned about liberalization of outflows or of inflows of capital. Moreover, note that any changes in wages will come from a change in (inverse) labor demand, which

can be expressed solely a function of the price of output and the rental rate on capital, so that any changes in wages due to a capital market liberalization will come from a change in prices (output prices and the interest rate).

If input markets are competitive but output markets are oligopolistic or monopolistic<sup>2</sup>, an increase in capital mobility will lead to capital inflows to capital-poor countries. However, once again, wages will be equated with marginal revenue products so that all changes in wages will be attributable to changes in the capital stock which, in turn, are due to changes in the interest rate as well as subsequent impacts of the changes in the capital stock upon international price setting which effects marginal revenue product. Again, without any price changes, there will be no wage changes and all changes in wages will ultimately occur from changes in the price of outputs or changes in the price of capital.

Having considered capital market liberalization in a neo-classical setting, we now look at a third possibility: the case where there are imperfections in the capital market but not in the labor market. The standard case is one of asymmetric information in the lending of capital leading to quantity rationing in the provision of capital. Suppose that an outflow liberalization occurs under these circumstances, and that capital outflow occurs as a result, reducing the domestic supply of capital. In this case, a capital-poor country would still most likely be a net recipient of capital from a simultaneous liberalization. When a group of countries simultaneously liberalize, the

only way in which wages would be affected would be through changes in the marginal product of labor which are associated with changes in the capital stock. However, since capital was rationed before the liberalization, there is little or no effect upon the interest rate; capital flight merely affects the degree of rationing of capital, not the interest rate. As a result, wages, which are equated with the marginal product of labor, change but the changes are not associated with changes in the interest rate. In this case, the changes in wages are associated with changes in the levels of the capital stock.

We now move to the third and last market which could effect the relationship between wages and capital market liberalizations : the labor market. We take as the most important example, the collective bargaining relationship between firms and workers. In this situation, in addition to allowing for an equalization of the rates of return to capital across countries achieved by an actual flow of capital, because wages are not determined by equation with marginal products but rather are determined through bargaining which depends upon the ability of each party to threaten the other with leaving the relationship, an increase in capital's outside option by the opening of other markets increases their ability to threaten unionized workers with plant relocation which will lead to a wage reduction. This may happen even in the absence of changes in output prices, capital prices, or movements of physical capital. Moreover, in both countries which are recipients of capital and countries which are exporters of capital, wages may fall (from simultaneous outflow liberalization). So, if we could figure out if labor markets deviated systematically from the competitive model, we could gain

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<sup>2</sup> These results do not depend upon the degree to which producers collude to keep

support for the notion that unions are not misguided in opposing capital market liberalizations<sup>3</sup>. However, our theory identifies a natural way for us to simultaneously ascertain whether or not wages are determined at competitive levels<sup>4</sup> as well as the level of the impact of the threat effect from capital market liberalizations upon wages; we can look at the changes in wages which are not explained by changes in prices of output goods, the price of capital, or the quantity of capital. It is to this empirical issue which we now turn.

### *Capital Market Liberalizations*

In the previous section, we discussed why a capital market liberalization may increase the ability of firms to make threats to their workers in demanding wage concessions. In this section, we will analyze at a more microeconomic level how that

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prices high.

<sup>3</sup> Similar arguments can be made for trade-market liberalizations except they are somewhat more involved arguments because the increase in the ability of capital to threaten labor has to do with capital's increased ability to relocate due to changes in the product market. The main reasons we have not explored trade-market liberalizations in this paper are because (1.) we believe that effects of capital market liberalization will be larger in magnitude and (2.) due to the externalities involved, it is rare to see unilateral trade liberalization which is a requirement for the empirical methodology we use.

<sup>4</sup> Note this is different from saying that wages are competitively determined... obviously in a unionized settings, wages are not determined competitively; however, it is possible according to some authors (and even necessary for some) that wages be determined at competitive levels even in the presence of union bargaining. Thus, unions don't offer wage premiums for their workers but rather only make unionized firms more selective

threat actually occurs.<sup>5</sup> There are effectively three ways in which capital markets are liberalized : (1.) Outward Foreign Direct Investment (FDI) Liberalizations<sup>6</sup>, (2.) Portfolio Liberalizations, and (3.) Foreign Exchange Liberalizations. Each of these liberalizations allows individuals as well as firms to transfer money more freely across borders. This potential mobility increases alternative uses of the domestic supply of capital which in turn allows for the exercise of the threat effect as a wage disciplining device.

Foreign exchange liberalization is extremely important for capital market flows. Firms wanting to locate capital abroad must be able to transfer their funds to the given foreign country. Since foreign investment will be done in foreign currency, it is necessary that domestic citizens be able to exchange their currency (or that their bank be willing to exchange foreign currency for domestic). Even if a country has liberal laws regulating international direct foreign investment, these are relatively meaningless in the presence of stringent control of foreign exchange. Similarly, if currency flows are liberalized but it is not possible to obtain permission to invest directly abroad, then the liberalization will have little effect on outflows of domestic capital. This is true both for direct investment (investment in physical capital) and for portfolio investment (investment in financial capital). Either of these two types of liberalizations or more generally the foreign exchange liberalizations free up domestic capital by providing

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about the purported 'quality' of the labor force they employ relative to non-unionized firms in the industry.

<sup>5</sup> For an illuminating discussion of the relocation threat tactics utilized by American firms in an attempt to thwart unionization, see Bronfenbrenner (1996).



greater opportunities abroad. We will now investigate when FDI liberalization impacts wages and when portfolio liberalization does.

In order for the threat of relocation to effect wages, foreign opportunities for capital must have at least as high a return as the next best domestic opportunity for the firm in question. This means that in particular, relocation must offer higher returns to the firm than staying anywhere else in the domestic market. But, in order for a *threat effect* to exist, the firm must prefer to keep its domestic plant operating rather than relocate abroad (otherwise the firm would not threaten to leave, it would actually leave) and it also must prefer relocating abroad to relocating domestically. Therefore for a threat effect to exist, two preconditions must be satisfied : (1.) large amounts of firm or plant-specific human skills in the existing plant location – this guarantees that the firm in question prefer remaining in its current plant to relocating abroad and (2.) general productivity benefits from relocating abroad – which guarantees that the firm prefers foreign relocation to domestic relocation.

Even when it is more profitable to produce in a foreign country than in the domestic one given relocation costs, it still may not be feasible for a firm to threaten to leave and use that threat to gain wage concessions. The threat to create a new plant abroad (or to shut down domestic operations and place money in an international hedge fund) is not sufficient for threats to have a large effect upon wages. It must also be the case that new possibilities for international investment crowd out domestic possibilities.

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<sup>6</sup> It is also possible that inward FDI liberalizations can lead to increased threat effects

This can happen under one of three circumstances (or any subset of these circumstances). The first circumstance occurs when the producing firm would experience a sufficient fall in revenue from the operation of two plants that it is not worth it to do so. This could happen if the firm faced a strongly downward sloping demand curve for its products. It could also happen if a firm sells through its distributors who only have a limited demand for the products of the given firm not because of strongly downward sloping market demand but rather because they do not have the connections to be able to rid themselves of the extra products. The second of these reasons is different from the first in that it is primarily an informational rather than demand problem. A third reason for a declining marginal revenue from production is firm-level (though not plant level) decreasing returns due to managerial and organizational costs.

The second way in which the opening up of profitable foreign production opportunities could crowd out domestic production is if firms face upward-sloping costs of capital (or credit rationing in the presence of a highly indebted firm). This could be due to standard incentive effects of indebted firms or more nuanced adverse selection and moral hazard problems in banking. In the case of an upward sloping cost of capital or credit-market rationing, it may be too costly or impossible for the firm to raise funds in order to operate two separate firms. However, it may be quite feasible from selling off the original plant and not paying wage and variable capital bills in the domestic country, for a firm to finance its production abroad.

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due to greater ease of repatriating capital causing an outward flow of domestic capital.

One crucial aspect of *threat effects* to note is that they must be threats rather than relocations. For an increased threat to come about from an opening of international capital markets, it must be the case that firms have better opportunities for relocation abroad than domestically. The most likely reason why a firm might have better opportunities internationally but yet remain (i.e. exercise a *threat* rather than relocate) in domestic production is that there is a certain amount of specificity to domestic production at the particular site which would be lost in a domestically or internationally relocated plant. The sources of these specificities can either be physical such as transportation costs and building costs for specific capital or non-physical such as organizational knowledge or location-firm-specific human capital which accrue to the existing site of production.

Now that we have a sense of the necessary preconditions for the existence of wage concessions due to threat effects, we can look at the probable effects of different types of liberalizations. Exchange control liberalizations, relaxations on the restrictions over exchanging currency, will tend to have threat effect consequences to the degree that exchange restrictions were a binding constraint on foreign direct investment (and to a lesser degree portfolio investment) previous to the liberalization. FDI liberalizations, relaxations over the restrictions of allowing domestic funds to be used for the purposes of investment in foreign plant and equipment, will tend to have an effect when the above mentioned conditions are satisfied (either upward-sloping cost of capital or downward sloping marginal revenue).

The least effective type of capital market liberalization in terms of its effect upon disciplining wages is portfolio investment liberalizations. To see why, consider the two

conditions noted above that give rise to the threat effect after a FDI liberalization: downward sloping marginal revenue and upward sloping cost of capital. Suppose that a portfolio investment liberalization causes a domestic shoe manufacturer to want to allocate some capital in portfolio investing. He will not be constrained in doing so by a downward sloping demand curve for his product (shoes) since his new investment is not in shoe production. In other words, he could conceivably maintain his current level of shoe production *and* start a hedge fund. So he could not threaten his workers for concessions on the grounds that he could not possibly maintain his current level of production while engaging in his new project. But his ability to engage in both projects *would* be hampered by an upward sloping cost of capital curve. If he were faced with this situation, he would be able to levy a threat of closure or layoffs his workers *because* engaging in portfolio investing would mean completely switching out of shoe production. But the manager is not likely to threaten to switch from shoe manufacturing to a hedge fund operator as a result of portfolio liberalization even in the presence of an upward sloping cost of capital curve, because he is likely to have considerably more information and expertise (and probably less subjectively evaluated variance in returns as a result) in his current industry of production. Also, even if international returns are higher than domestic productive ones, it may not be possible for a domestic producer without investing expertise to take advantage of those high returns. Lastly, many domestic producers may identify their selves with their business and may not be willing to leave their business even for a higher return in another business. For all of these reasons, the types of capital market liberalizations which will have the greatest effect upon wages will tend to be those that liberalize direct foreign investment possibilities

either by releasing restrictions on FDI directly or doing so indirectly by liberalizing exchange controls.

## **II. Methodology**

In the previous section we discussed some theoretical issues surrounding the manner in which capital market liberalization may effect wages. In particular we outlined how effective liberalizations of FDI could give rise to a threat effect which would decrease wages beyond the standard neoclassical channels of output price or capital price (or capital stock, in the presence of capital market imperfections). Our aim in this section is to specify an empirical framework that will allow us to interpret post-FDI-liberalization wage changes not associated with changes in prices or capital stock as a threat effect on wages.

### **A. Using a Regulatory Change to Identify the Effect of Capital Flow Liberalization**

Our approach consists in attempting to identify the effect of capital flow liberalization on wages by examining the differential wage behavior of a pair of countries, economically similar in most relevant respects, in which one country liberalized capital markets earlier than the other. If everything else about the countries were identical during the comparison period, the difference between the change in wages in the treatment country and the change in wages in the control country could be interpreted as the effect of the policy change on wages. A candidate pair for this type of analysis is Taiwan and Korea around 1987, when Taiwan moved to decrease its restrictions on outflows of direct foreign investment. In order to demonstrate the

appropriateness of Taiwan and Korea for this analysis, we will (1) review the substance of the 1987 Taiwanese liberalization and review the capital market regulatory environment in Korea during the same period; and (2) compare the two countries with respect to several important macroeconomic statistics to establish their economic similarity.

In 1987, Taiwan passed several liberalizing amendments to its foreign exchange regulatory policy (known as the Statute for the Administration for Foreign Exchange (SAFE)) that had significant implications for inward and outward FDI. Prior to 1987, Taiwanese companies were highly restricted with respect to allowable uses of foreign exchange earnings. Under the “surrender” system, “foreign exchange earnings resulting from the exports of goods and services had to be sold to the [Chinese Central Bank] or appointed banks that had been authorized by the CBC to engage in foreign exchange transactions.”<sup>7</sup> The 1987 SAFE amendments included new regulations on inward and outward foreign exchange remittances, which allowed earnings and payments arising from exports of goods and services to be freely converted into and out of New Taiwan Dollars. This change facilitated outward FDI for Taiwanese companies by making it easier for them to procure the currency they needed to make such investments. But other, non-SAFE, regulations regarding FDI were still in place which restricted the extent to which the SAFE amendments could impact FDI. The 1987 amendments allowed *individuals* to undertake FDI, without the need for government approval, of up to US\$3 million annually. Corporations, however, were still required to secure prior approval for FDI from the Ministry of Economic Affairs. In 1989, a new regulation was enacted that allowed corporations the same freedom as individuals.

Still, the 1987 SAFE amendments marked a major turning point in Taiwanese direct investment regulation. Brian Semkow, a chronicler of Taiwanese capital market and capital account regulation reports that “the growth abroad of direct investment generally, and M&A specifically, is attributable, in large part, to the liberalization of the statutory and regulatory framework that governs investment and foreign exchange. The 1987 SAFE Amendments marked the first turning-point in that, prior to these amendments, direct investment abroad was very low.”<sup>8</sup> This statement is lent support by Figure 2, which shows Taiwanese outward FDI clearly taking off beginning in 1987. For our purposes it is not necessary that outward FDI actually increased, but rather only that manufacturers viewed FDI as easier (more of a credible threat) than previous to 1987. Nevertheless, the actual increase in outward FDI after 1987 combined with Semkow’s comments provide support for the plausibility of an increased *threat effect*.

We also need to verify that similar changes in capital account regulation were not occurring in Korea during the same time period. Data on Korean capital account liberalization, unlike that for Taiwan during the period in question, is reported in the IMF’s *Yearbook of Exchange Arrangements and Restrictions* series. From this source, two things are clear. First, Korea did experience some outward FDI liberalization during the period 1987-1990 increasing the amount of FDI permitted without prior approval from US\$2 million to US\$3 million. Second, Korea experienced its major outward FDI liberalization in 1990, raising the allowable ceiling on outward FDI from US\$3 million to US\$100 million. On the one hand, these liberalizations seem small, especially compared to the 1990 liberalization. On the other hand, Figure 2 suggests that these liberalizations

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<sup>7</sup> Semkow (1992), 155.

may have had some impact on Korean outward FDI. The impact seems to be far less than that of the Taiwanese liberalization. It is important to note that over the period 1981 to 1991, Taiwanese outward direct investment went from 30% as large as Korean outward direct investment to 150% as large. At first glance, two criticisms of the choice of the 1987 exchange control liberalization as a useful policy change to identify effects of liberalization come to mind. First, the fact that Taiwan undertook the liberalization in 1987 and Korea did not arouses suspicion that perhaps the policy was undertaken for reasons associated for unobservable idiosyncratic Taiwanese factors. The second criticism of the liberalization is that it was only 3 years apart from the Korean liberalization so that there was not enough time to identify an 'effect' of liberalization. The second concern will be investigated empirically in the remainder of the paper. At first glance, however, the strikingly differential behavior of real wages in Korea and Taiwan beginning precisely in 1987 (see Figure 3) gives some reason to believe that the three year time window may have been sufficient for the manifestation of an effect. Also, however, the fact that the two liberalizations did in fact occur so closely together in time gives credence to the notion that the policy choice was not due to idiosyncratic factors specific to Taiwan.

We next turn to the case for viewing Taiwan and Korea as a closely matched country pair. First, a brief word on why it is important for our analysis that Taiwan and Korea be macroeconomically similar. Since the difference in difference analysis relies crucially on one country acting as a "control" for the other country which has experienced a "treatment" effect, it is necessary that any economic activity not having to do with capital market liberalization have roughly identical effects across the countries.

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<sup>8</sup> Semkow (1994), 281.



To be confident that this is the case, we need to establish that the structures and resources of the economies will likely produce parallel economic evolution as changes occur through time. Tables 1 through 5 and Figures 2 through 4 review a few significant demographic and macroeconomic statistics for Taiwan and Korea. Table 1 shows that Korea was roughly 2 times the size of Taiwan in terms of population from 1981-1990. The difference between the two in GDP per capita is smaller, however, beginning with Taiwanese GDP per capita at roughly 1.4 times that of Korea in 1981, with the gap narrowing over time (Table 2). And Figure 4 shows that both countries had low unemployment during the period, at about 2% for Taiwan and between 2% and 5% for Korea. Taiwan tended to have a somewhat higher proportion of government spending in GDP—roughly 14% versus roughly 9-10% for Korea (Table 3). Also, Korea's government share was declining slightly during the period while Taiwan's was holding steady. Non-government investment as a percentage of GDP was slightly higher in Korea than in Taiwan—rising from 27-37% while Taiwanese investment share fell from 28% to 23% (Table 4). As Figure 5 shows, consumer prices grew at a somewhat higher rate in Korea over this period, but consumer price inflation in both countries was low. And the two countries were similar with respect to degree of openness to trade ((exports + imports)/GDP) as well (Table 5). Despite small differences, these generally statistics lend support for the macroeconomic similarity of the two countries from 1981-1991.

One substantial difference that should be noted is in the behavior of producer prices. As Figure 6 shows, Korean producer prices rose from 1981 to 1982, were roughly flat from 1982 to 1987 and then rose steadily thereafter. Taiwanese producer prices, on the other hand, actually *fell* steadily during the period 1984-1990. Our data on prices were obtained from the Statistical Yearbook of the Republic of China, and we are in the

process of trying to identify other sources of price data to check this surprising fall in producer prices.

Based on the above comparisons, we believe there are grounds for conducting a differences in differences analysis with Taiwan and Korea during the time period surrounding Taiwan's capital flow liberalization. We now turn to the issue of specifying an econometric model to identify the effect of capital market liberalization on wages.

**i. Primary Specification: A Reduced form Difference in Difference Approach**

We begin with a competitive labor market setting in which wages adjust to equilibrate labor demand and supply.<sup>9</sup> Assuming that labor demand is log linear, we can express the labor demand equation as:

$$[1] \quad \ln L_{it} = \beta_0 + \beta_1 \ln P_{it} - \beta_2 \ln W_{it} + Z_{it} \Pi + \varepsilon_{lit}$$

Where  $t$  is a time period subscript,  $i$  is an industry subscript,  $Z_{it}$  is a vector of observed variables affecting labor demand,  $\Pi$  is a vector of parameters,  $P_{it}$  is a measure of producer prices,  $W_{it}$  the wage and  $\varepsilon_{lit}$  is an error reflecting unmeasured labor demand shocks.

Similarly, log labor supply can be represented as:

$$[2] \quad \ln L_{it} = \alpha_0 + \alpha_1 \ln W_{it} + H_{it} \Gamma + \varepsilon_{2it}$$

Where  $H_{it}$  is a vector of observed variables affecting labor supply,  $\Gamma$  is a vector of parameters,  $W_{it}$  the wage and  $\varepsilon_{2it}$  is an error reflecting unmeasured labor supply shocks.

Labor market clearing yields the following reduced form expression for wages:

$$[3] \quad \ln W_{it} = \gamma_0 + \gamma_1 \ln P_{it} + H_{it} \Phi + Z_{it} \Lambda + \nu_{it}$$

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<sup>9</sup> This approach closely follows Revenga (1992) and Card and Kreuger (1992).

Where  $\Phi$  and  $\Lambda$  are vectors of parameters multiplying the variables  $H_{it}$  and  $Z_{it}$ , respectively, and  $u_{it}$  is an error term.

If wages are as in equation [3] then, with data from two economically similar countries, one of which experienced a capital market liberalization during a given time period while the other did not, we can utilize a Difference-in-Difference (DD) framework to identify the effect of a capital market liberalization on wages. As in Card & Krueger (1992), assuming that (1) other factors that affect wage (i.e. the variables in  $X$ ) have not changed differentially in the two regions over time, and (2) the levels of these variables are roughly comparable, or that differences in the levels do not matter, we can identify the effect through the following DD specification:

$$[4] \quad \ln W_{i,c,t} = \beta_0 + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + X\Pi + u_{i,c,t}$$

Where  $\delta^{TAI}$  is a dummy variable for Taiwan,  $\delta^{AFTER}$  is a dummy variable for time periods after the year of Taiwanese liberalization,  $X$  is a vector of variables affecting wages which includes all interactions with the country and time dummies<sup>10</sup> and  $\Pi$  is a vector of parameters. The subscript  $i$  refers to industry,  $c \in \{\text{Taiwan, Korea}\}$  refers to country, and  $t \in \{\text{after liberalization, before liberalization}\}$  refers to time period. Note that we are dealing only with two time periods. (We discuss below the possibility of utilizing a more continuous time-series of year.) Differencing over time, the DD equation becomes

[5]

$$\Delta \ln W_{i,c} = \beta_2 + \gamma_{DD} \delta_{i,c}^{TAI} + \Phi_1 \Delta X_{i,c} + \Phi_2 \delta_{i,c}^{TAI} \Delta X_{i,c} + \Phi_3 X_{i,c,a} + \Phi_4 \delta_{i,c}^{TAI} X_{i,c,a} + \xi_{i,c,t}$$

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<sup>10</sup> For example, if one of the variables is  $I$ , “net capital investment,”  $X$  will also include  $I * \delta^{TAI}$ ,  $I * \delta^{AFTER}$  and  $I * \delta^{TAI} * \delta^{AFTER}$ .

Where  $\Delta X_{i,c}$  refers to the variables in  $X$  differenced across the time periods within country, and the  $\Phi$ 's are vectors of parameters (they are subvectors of the vector  $\Pi$  from equation [4]). Differencing again between Taiwan and Korea gives:

$$[6] \Delta \Delta \ln W_i = \gamma_{DD} + \Phi_1 (\Delta X_{i,Tai} - \Delta X_{i,Kor}) + \Phi_2 \Delta X_{i,Tai} + \Phi_3 (X_{i,Tai} - X_{i,Kor}) + \Phi_4 X_{i,Tai} + \eta_i$$

We can see that if the variables in  $X$  satisfy the two conditions mentioned above, then all of the terms except  $\gamma_{DD}$  and the error go to zero. The second term goes to zero if the variables in  $X$  have not changed differentially across the countries (i.e.  $(\Delta X_{i,Swe} - \Delta X_{i,Fin}) = 0$ ), or if such differences do exist but have no affect on wages (i.e.  $\Phi_1 = 0$ ). The third term goes to zero if changes in the Taiwanese  $X$  variables do not have a differential effect on wages from the effect of changes in Korean  $X$  variables (i.e.  $\Phi_2 = 0$ ). The fourth term goes to zero if the levels of  $X$  are roughly the same across the countries (i.e.  $(X_{i,Swe} - X_{i,Fin}) = 0$ ), or if a difference does exist but has no affect on wages (i.e.  $\Phi_3 = 0$ ). The fifth term disappears if Taiwanese  $X$ 's do not have a differential effect on wages from Korean  $X$ 's (i.e.  $\Phi_4 = 0$ ). If these conditions hold, then we can write the period-differenced equation in the familiar form:

$$[7] \quad \ln W_{i,c,after} - \ln W_{i,c,before} = \beta_2 + \gamma_{DD} \delta_{i,c}^{TAI} + v_{i,c,t}$$

But we have two additional issues to address that will lead us to a slightly different specification: (1) the variables in  $X$  may change differentially over time across the two countries, (2) the policy change may have its effect with a lag and/or gradually over time, so that comparing single "before" and "after" periods may be inadequate for our purposes. We discuss the implications of each of these in turn.

The first issue is straightforward. If  $X$  changes differentially over time across the two countries then the variables in  $X$  will not disappear in the differencing, and we will

need to estimate the DD equation in its general form, [5]. This, in turn, requires an interpretation of  $\gamma_{DD}$  slightly different from that of the  $\gamma_{DD}$  in the simple equation [6]. In [6]  $\gamma_{DD}$  is meant to represent the entire effect of the policy change—here, the capital market liberalization. In [5], however,  $\gamma_{DD}$  represents only a part of the effect. In particular, it represents the shift in the intercept of the regression line. In order to measure total effect of the liberalization, we must focus additionally on  $\Phi_2$  and  $\Phi_4$ , which measure the increment in slope to Taiwanese industries on changes in  $X$  variables, and levels of  $X$  variables, respectively. To be more explicit, suppose that  $\Delta X = (\Delta x_1, \dots, \Delta x_n)$ ,  $\Phi_1 = (\phi_{1,1}, \dots, \phi_{1,n})$  and  $\Phi_2 = (\phi_{2,1}, \dots, \phi_{2,n})$ . Consider the change in variable #1,  $\Delta x_1$ . For Taiwanese firms, a unit change  $\Delta x_1$  corresponds to a  $\phi_{1,1} + \phi_{2,1}$  change in differenced log wages. For Korean firms, a unit change  $\Delta x_1$  corresponds only to a  $\phi_{1,1}$  change in differenced log wages. Therefore,  $\phi_{2,1}$  measures the impact (possibly zero) of the capital market liberalization on returns to changes in  $X$  variables. Similarly, the parameters in  $\Phi_4$  measure the impact of the capital market liberalization on returns to levels of  $X$  variables. Of course, one of the main purposes of choosing macroeconomically similar country pairs is to make plausible the DD identifying assumption that all of these effects are negligible. [In our results section, we will check the legitimacy of this assumption].

The second issue is the possible inadequacy of utilizing only two comparison time periods. There are two reasons why this approach may misidentify the effect of the policy change. First, as mentioned above, the policy change may have a lagged or gradual effect. Second, we could not be sure that our “before” year was an appropriate base year. An unobserved macroeconomic shock of some kind could make data from the chosen base year aberrant. One way to address these issues is by using a more continuous time-series of data rather than simply single “before” and “after” time

periods – the subscript  $t$  in equation [4] now represents all years in the sample rather than just “after” and “before.” In using more than two time periods, we can no longer utilize the similarity Taiwan and Korea to simply difference out any wage effect that is not due to the capital market liberalization (which, by assumption, is ostensibly the only major uncontrolled difference between the two during this time period). But we can still benefit from the “treatment” and “control” nature of the data from the two countries by pooling the data and creating a variable to identify an effect on wages of being in Taiwan after the liberalization.<sup>11</sup>

Specifically, if we pool the data and control (through the vector  $X$ ) for effects other than capital market liberalization that might affect wages, then a dummy variable equaling unity in post-liberalization Taiwan and zero elsewhere would identify the wage effect of liberalization. The equation reflecting this specification is:

$$[8] \quad \ln W_{i,c,t} = \beta_0 + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + X\Pi + u_{i,c,t}$$

where  $\delta^{TAI}$  is defined as before, and  $\delta^{AFTER}$  is a dummy variable taking on a value of 1 for observations in years 1987 and after.  $X$  is a vector of variables that may affect wages, and corresponds to  $H_{it}$  and  $Z_{it}$  from equation [3] above. We discuss below which variables we include in this vector. Note that the interpretation of  $\gamma_{DD}$  in [8] is very similar to that of the standard DD coefficient (i.e. that of equation [7]). It represents the effect on wages of being in post-1987 Taiwan relative to pre-1987 Taiwan *minus* the effect of being in post-1987 Korea minus the effect of being in pre-1987 Korea, controlling for other relevant factors. Since we assume that Taiwan and Korea are economically similar during this time period, we do not include time and country dummy interactions with

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<sup>11</sup> If the industry categories are identical across countries, we can also use the data as a

the  $X$  variables – since this would imply that changes in the  $X$  variables differentially affect wages across the two countries.

Note that by capturing the effect of the liberalization using a dummy variable, we only identify a single affect of being in the post-liberalization regime in Taiwan *regardless of how far away from the liberalization the observation is*. An alternative approach would be to attempt to measure the one-time effect of the capital market liberalization in the year it occurred separately from the ongoing effect after the liberalization. We can do this by introducing an additional variable that measures, for each observation, the cumulative number of years since the Taiwanese liberalization.<sup>12</sup> This variable will take on a value of zero for all Korean observations, and will take on a non-negative integer value for all Taiwanese industries, indicating how many years they have been in the post-liberalization regime. Specifically, we can alter equation [4] as such:

$$[9] \quad \ln W_{i,c,t} = \beta_0 + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \beta_3 N_{i,c,t}^{LIB} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + X\Pi + u_{i,c,t}$$

Where  $N^{LIB}$  is the variable indicating the number of years since liberalization in the home country, as before  $X$  does not include interactions of the observable covariates with  $\delta^{AFTER}$  and  $\delta^{TAI}$ .

As before,  $\gamma_{DD}$  represents the effect on the intercept of the regression line of being in a post-liberalization regime. But with the addition of  $N^{LIB}$ , we can now also allow for a different ongoing effect of the liberalization. For example, the effect of liberalization is  $\gamma_{DD} + N^{LIB}$  in year 1 of the liberalization regime,  $\gamma_{DD} + 2*N^{LIB}$  in the 2<sup>nd</sup> year of the liberalization regime,  $\gamma_{DD} + 3*N^{LIB}$  in the 3<sup>rd</sup> year of the liberalization regime, and so on.

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panel to run an industry fixed effects regression. This is discussed below.

<sup>12</sup> This approach mirrors that of Krueger (1999).

We can also allow for non-linearities in the ongoing effect of liberalization by adding a non-linear  $N^{LIB}$  term, e.g. by adding individual year dummies defined as  $(YEAR)*\delta^{TAI}*\delta^{AFTER}$ . In our regressions, these dummies will be labeled TAI87 through TAI91.

#### *Contents of the X vector*

As discussed above, capital account liberalization should only affect wages through output prices or input prices (i.e. the price of capital) or, in the event that there are capital market inefficiencies, changes in capital. This derives from standard micro-economic theory. An additional factor that arguably should be included is some measure of an “alternative wage” for workers. In the neo-classical framework, the alternative wage could enter into the labor supply function as a shift term – e.g. for a manufacturing worker, if wages in the service sector increase, this could decrease her desire to supply labor to the manufacturing industry. In a bargaining framework, the affect of changes in the alternative wage is more straightforward and less awkward – it affects the union’s threat point in negotiations. However, in this paper we are interested only in ascertaining whether or not capital market liberalization affects wages *in some way other than through prices and capital stock* – and not in trying to establish precisely what that other way is. Therefore, we include alternative wages in the specification solely as a determinant of labor supply in the neo-classical framework. In addition to these covariates, we need to control for changes in wages that occur as a result of business cycles. Toward that end, we include unemployment rate. The complete set of covariates composing the X vector, then, is: producer prices, real interest rate, gross



fixed capital formation (as a proxy for capital stock),<sup>13</sup> unemployment rate and alternative wage.

## ii. Endogeneity and IV

One major criticism of the framework we have presented so far is that changes in prices are not exogenous variations in prices but in fact are more often than not endogenous changes reflecting changes in, for example, the prices of other tradable inputs of production in the industry. For example, if the price of steel goes down, this may effect a drop in the price of cars in addition to a rise (drop) in the wages of labor if steel and labor are gross substitutes (gross complements) in production. This will induce a positive (negative) bias in the coefficient on prices and most likely a negative (positive) bias on the coefficient on the impact of the Taiwanese liberalization. Though on average, we expect that such shocks which effect both prices and wages will tend to effect them in the same direction so that, more than likely, we will underestimate the impact of the liberalization upon wages, we want to be careful and therefore for a robustness check, we intend to reproduce our results with instrumental variables in future drafts.

Econometrically, the endogeneity problem consists in a non-zero correlation between our error term from the labor demand equation [1] and prices which induces a correlation between our error term in our regressions [8] and [9] and the price variable. As an instrument for prices, we follow Ana Revenga (1992) in using industry exchange

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<sup>13</sup> This is an imperfect proxy for capital stock. In future drafts we hope to use at least net

rate weighted industry labor costs. This effective index of foreign labor costs for manufacturing goods will clearly be correlated with domestic labor wages; however, the only plausible channel for this correlation is through goods prices. Since there is little reason to believe that labor would suddenly systematically become more productive across Taiwan and Korea over the time period in question, it seems more plausible that changes in labor costs across countries are due in large part to changes in prices than to changes in labor quality. Therefore, the changes in foreign labor costs should be on the one hand correlated with domestic prices and on the other hand uncorrelated with the error term effecting domestic wages. Intuitively, we are looking at the impact of foreign changes in labor costs which go through domestic prices and on to domestic wages. We believe the only reason for such changes in wages is due to the effect upon prices.

It is also possible that we could have similar problems with other of our right hand side variables: the interest rate, gross fixed capital formation, and the alternative wage. For the interest rate and gross fixed capital formation, shocks to the existing capital stock could induce large depletions, causing the interest rate to rise but also simultaneously causing wages to fall in which case (not showing up in gross fixed capital formation either), the impact of the interest rate upon wages may show up strongly potentially at the expense of the impact of the liberalization upon wages. Similarly, there is a strong possibility that what we use for an alternative wage to capture labor supply effects, the wages in restaurant and hotel services, will actually rise for unobserved reasons at the same time as rises in many manufacturing industries due to, for example, general increases in educational levels or in improvements in public

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fixed capital formation if not actual capital stock.

goods such as computer connections which effect multiple industries. At this point in time, we do not have instrumental variables to deal with these problems. Nevertheless, we believe that at best, these endogeneity problems, causing greater positive correlation between LHS and RHS variables, will most likely reduce the value of our estimate of the impact of capital market liberalization upon wages. We therefore are not as concerned with testing the robustness of these findings by instrumenting for these right hand side variables.

### iii. Fixed Effects

Using the specification in equation [8] or [9] implicitly includes the restriction that the constant term is the same across all industry-country-year cells. This may be an overly restrict assumption for several reasons. One reason that is important for our analysis is that there may be heterogeneity across industry wage levels which does not vary across countries, and is not captured by our right hand side regressors. Further, this heterogeneity may change over time. If so, and if we restrict the constant term to be the same across all industry-time cells, then the coefficients on our right hand side covariates may be picking up some of the true constant term effect. One method for dealing with this is to treat the data set as a panel of industry or industry-year groups, and allow each group to have its own constant terms in a fixed effects regression. To do industry fixed effects, we would add an  $i$  subscript to the constant term. Equations [8] and [9] become:

$$[8'] \quad \ln W_{i,c,t} = \beta_{0i} + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + \text{XII} + u_{i,c,t}$$

$$[9'] \quad \ln W_{i,c,t} = \beta_{0i} + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \beta_3 N_{i,c,t}^{LIB} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + \text{XII} + u_{i,c,t}$$

Or, to make the model even less restrictive, we could create groups at the industry-year level by adding an additional  $t$  subscript to the constant term:

$$[8''] \quad \ln W_{i,c,t} = \beta_{0it} + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + X\Pi + u_{i,c,t}$$

$$[9''] \quad \ln W_{i,c,t} = \beta_{0it} + \beta_1 \delta_{i,c}^{TAI} + \beta_2 \delta_{i,c,t}^{AFTER} + \beta_3 N_{i,c,t}^{LIB} + \gamma_{DD} \delta_{i,c}^{TAI} \delta_{i,c,t}^{AFTER} + X\Pi + u_{i,c,t}$$

Two issues should be mentioned with respect to the fixed effects specification.

First, this specification addresses the endogeneity issues mentioned in the previous section if the endogeneity comes in the form of a worldwide (or region-wide) exogenous shock affecting both wages and the right hand side variable in question. It can be shown algebraically that fixed effects regression is identical to regressing “within group deviation from means” left hand side variables on “within group deviation from means” right hand side variables.<sup>14</sup> That is, the fixed effects regression is equivalent to regressing  $(\ln w)_{i,c,t} - (\ln w)_{(i,t)\bullet}$  on  $(\ln x)_{i,c,t} - (\ln x)_{(i,t)\bullet}$ . Where a dot represents across-country (within group) averages. With just two countries, it is simple to show that this reduces to regressing  $\frac{1}{2}((\ln w)_{i,c1,t} - (\ln w)_{i,c2,t})$  on  $\frac{1}{2}((\ln x)_{i,c1,t} - (\ln x)_{i,c2,t})$ —in other words, it is equivalent to running the OLS regression with within-group differenced data.

Therefore, if endogeneity is being caused by an exogenous shock that affects both countries, this effect will be cancelled out in the fixed effects regression. Of course, if the two countries are affected systematically differently by the shock, fixed effects will not solve the problem although it may ameliorate it. Also, the other types of endogeneity mentioned in the previous section will not be helped by fixed effects.

The second issue with respect to the fixed effects specification is the problem of exacerbation of attenuation bias from measurement error. It can be shown algebraically

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<sup>14</sup> Greene, *Econometric Analysis*, p. ???

that attenuation bias is made more serious in time series data by differencing.<sup>15</sup> And since our fixed effects specification is equivalent to running OLS on across-country/within-group differenced data, the coefficients generated by this specification would suffer from attenuation bias more than would the standard OLS coefficients.

### III. Data

Our analysis utilizes wage, gross fixed capital formation and producer price data for a panel of 15 2- and 3-digit ISIC manufacturing industries in Korea and Taiwan during the period 1981 to 1991. We also employ interest rate, exchange rate, producer price index, consumer price index, unemployment and alternative wage (to be defined more precisely below) data at the country level. Sources and definitions for the variables are provided in Appendix 3. Several of the variables in the regressions required a bit of construction and we discuss them below.

The industry level variables came from two different sources, sometimes with differing industry classifications across countries. This necessitated defining our own 2- and 3-digit level ISIC code industry groupings, which in turn necessitated – in four instances for the Korean data and in three instances for the Taiwanese data – aggregating data. In these instances, we aggregated by adding together variables that were in levels, and used value of output as a weighting for index data. A list of the final industry categories and the aggregations performed can be found in Appendix 3. We used industry-specific producer price indices obtained from the *Korea Statistical Yearbook*

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<sup>15</sup> [Reference for this]

and the *Statistical Yearbook of the Republic of China* as our output price regression variables.

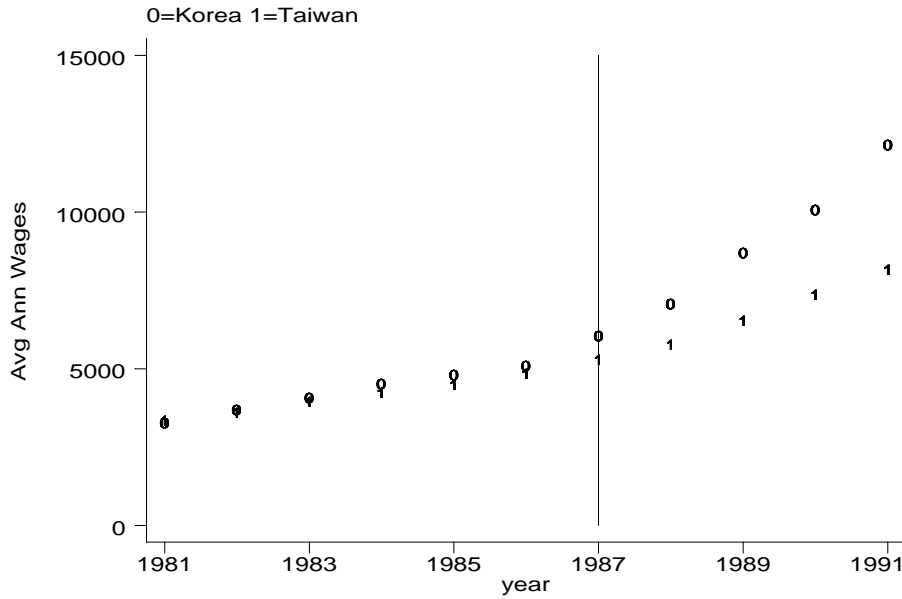
Wages were constructed as follows. From industry level aggregate monthly wage and salary and number of employee data we calculated average monthly wages and salaries per person in each industry, and multiplied by 12 to annualize. We then deflated the data to 1981 national currency using the country aggregate CPI, and converted the data into 1981 US dollars using the 1981 nominal US dollar exchange rate. Our alternative wage is the wage in the hotel and restaurant industry. It was converted into constant dollars in the same manner.

The gross fixed capital formation data were deflated to 1981 national currency using the aggregate country producer price indices and converted to US dollars using the 1981 nominal exchange rate. Nominal interest rates were converted into real rates by dividing by aggregate producer price inflation.

## IV. Results

We begin the presentation of our results by noting that Taiwanese and Korean real annualized wages in manufacturing grew in step until 1987, and diverged thereafter with Korean wages growing more quickly than Taiwanese wages (See Figure 3). And it was precisely in 1987 that Taiwan undertook major foreign exchange liberalization (the SAFE amendments), which had significant consequences for outward FDI.

**Figure 3. Average Annualized Wages in Manufacturing, Taiwan and Korea, 1981-1991 (1981 US\$)**



In the remainder of this section, we will present a sequenced discussion of the potential effects of taking into account various factors from the neoclassical story that may account for this growing gap in wages after 1987. To support the discussion, we present regression results from a series of different specifications. The main conclusion will be that, controlling for output prices, the price of capital (interest rate), alternative wages, business cycles (unemployment), and capital formation, we find that the gap in wages persists.

*a. Regressions and Discussion*

As discussed in the methodology section above, we analyzed the Korean and Taiwanese data using both OLS and fixed effects panel regressions. Specifically, we performed five regressions, the results from which are reported in Table 6.

The first regression (column (1) in Table 6) is an OLS regression of log wages simply on the dummies  $\delta^{TAI}$ ,  $\delta^{AFTER}$ , the interacted dummies  $\delta^{TAI} * \delta^{AFTER}$  and the variable  $NLIB$ , representing the interacted dummies multiplied by (year-1986).

The second and third columns of Table 6 are OLS regressions represented by [9] and a variant of [9] using the individual year effect dummies TAI87 through TAI91 discussed above. TAI91 was omitted from the regression because of multicollinearity.

The fourth and fifth columns of Table 6 are fixed effects regressions represented by [9'] and a variant of [9'] using the individual year effect dummies TAI87 through TAI91 discussed above. Again, TAI91 was omitted from the regression because of multicollinearity.

Rather than jumping right in to the regression results, we will attempt to build up the intuition behind the results by discussing in turn each of the neoclassical factors that could account for the observed growing gap between Korean and Taiwanese wages after 1987, the manner in which we would expect them to affect the gap, and then finally the actual effect that we see in the regressions.

The first potential complication we add to the simple story of Figure 3 is the effect of prices of output goods on wages. The basic neoclassical view of labor markets is that labor demand is completely determined by prices of output goods and the price of capital (which can be encapsulated by the interest rate). Since labor supply in manufacturing is completely determined by the opportunity cost of working in manufacturing (which we denote by wages in the restaurant and hotel sector because it is the only major sector of the economy with comparably low wage levels), these together should effectively account for the wages (or annualized wages) which we observe in the market. After taking into account these effects, there should, if labor markets are indeed not subject to bargaining, no effect of differential capital market



liberalizations. In other words, capital market liberalizations should effect wages only through prices and alternative wages.

To frame the discussion of the likely effects of prices on the behavior of Korean and Taiwanese wages after 1987, we turn to the actual producer price series from 1981-1991 (see Figure 6). We should first note that producer prices are the appropriate series to consider for our purposes, since these are the prices firms use to determine labor demand in the neoclassical theory. Unfortunately, as we can see in Figure 6, the price series for Taiwan is somewhat suspect as it shows a 10% decline in producer prices over the decade from 1981 to 1991. This is surprising considering, for example, that one might expect to see *increasing* producer prices in Taiwan after a foreign exchange liberalization for the following reasons. According to neoclassical theory, the impact of a foreign exchange liberalization upon prices would occur through an increase in the trade flow. Most likely, prices would, if anything, rise for domestically produced goods as foreign countries have greater access to Taiwan-produced products. And it is plausible that this effect would probably be larger than an effect upon prices through the capital market liberalization component. We are in the process of checking these numbers and trying to find alternative sources. Nevertheless, this correlation pattern actually works against the liberalization impact hypothesis because it most likely induces a potentially artificially high correlation between prices and wages (which we can see by the highly significant 31.4 percentage coefficient of prices on wages in regression 2), reducing the coefficient on the impact of liberalization.

We turn next to the interest rate. If the capital market liberalization were to cause a net capital outflow from Taiwan, the reduction in the supply of funds should lead to a rise in the real interest rate.<sup>16</sup> However, there is also a possibility that the liberalization could lead to a net inflow of capital as foreign investors realize greater possibilities for remittances of export earnings on goods manufactured in Taiwan. In fact, surprisingly, this latter possibility is exactly what happened in the wake of the 1987 currency exchange liberalization. Though there was a dramatic rise in FDI outflows in the years following 1987 (112.9% increase from 1987 to 1988 and 325.6% increase from 1988 to 1989) which potentially indicates a large rise in threats to workers in Taiwan, there was also a large increase in inflows so that on net flows increased in two out of the four years directly following the liberalization. The net effect upon interest rates, when combined with the Central Bank of China's impacts upon domestic real rates was to cause a decline in real rates for 1988 and steady rises through 1991 (see Figure 8). These rises in interest rates were correlated with stagnation in gross fixed capital formation which barely increased in Taiwanese manufacturing over the period of time in question while Korea experienced very large increases (see Figure 7). Even at an aggregate level in the economy, investment as a share of GDP remained stagnant in Taiwan in comparison with its Korean counterpart from 1987 until 1990. Over this period of time, Taiwan's investment share of GDP stayed within 2.4% of its 1987 share of 22.2% while the Korean share rose monotonically from 30.3% to 36.9% (see Table 4). So, as expected, the relative (to Korea) rise in interest rates in Taiwan were associated with relative (to Korea) declines in gross fixed capital formation in the manufacturing sector and even more broadly throughout the economy. It is somewhat surprising, of course, that

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interest rates did in fact increase given the increases in net foreign direct investment. Nevertheless, the rate of growth of net foreign direct investment was negative in 1988. Maybe this could help explain some of the interest patterns. In the final OLS regression (column 2 of Table 6), the coefficient on the real interest rate is slightly negative (zero to three digits and insignificant). This suggests that the standard neoclassical effect of interest rate increases leading to capital stock declines and effecting negative impacts on wages is so small as to not be readily discernible.

So far, we have considered a neoclassical input market structure. To the degree capital flows out of a liberalizing country, this should put upward pressure on the rental rate on capital or interest rate which should lower capital purchases by firms, lowering the marginal product of labor as well as wages. However, it is possible that capital outflows will lead to no or only small increases in the real interest rate due to credit rationing. In other words, Taiwan's domestic capital markets may not clear and the liberalization could have lead to a drop off in gross fixed capital formation. We allow for this possibility by including actual capital flows in the right hand side of the regression. Here also, the coefficient is not significant at the 5% level (though it is significant at the 14% level).

Having completely specified the labor demand side incorporating potential capital market imperfections and their effects upon labor demand, we now look at labor supply. We took as a proxy for labor supply effects, an alternative wage of the wage received in the restaurant and hotel industry. We chose this industry as a good indicator of outside manufacturing possibilities because (1.) it was one of the only

sectors which had an average wage as low as that in manufacturing and (2.) the jobs in the hotel and restaurant industry are not skill-intensive jobs so that it would be possible for a manufacturing sector employee to migrate into the hotel and restaurant industry. The correlation with alternative wage is quite large, positive and significant at the 5% level of confidence (see regression 2 in Table6). It is hard to believe that the alternative wage has such a large impact. Another possibility is endogeneity. We will explore this possibility as well as remedies in a future version of this paper.

We also included a cyclical variable, unemployment rate, to control for differential macroeconomic fluctuations. This was significant and unsurprisingly negative in both the OLS regressions we ran (columns 2 and 3 of Table 6). However, it turned insignificant in the fixed effects regressions (columns 4 and 5 of Table 6). Unemployment was decreasing in both Korea and Taiwan in the years following the liberalization. Also the rates were relatively close and, if anything, converging (See Figure 4). Therefore, unemployment, and more generally cyclical fluctuations, are not a likely candidate source of the differential wage behavior in Taiwan and Korea after 1987.

Finally, we look at the three dummy variables which capture the effect upon wages of being in Taiwan ( $\delta^{TAI}$ ), being in years after 1986 ( $\delta^{AFTER}$ ), and being in Taiwan after 1986 ( $\delta^{TAI} * \delta^{AFTER}$ ) respectively and additional year effects per year after liberalization in Taiwan ( $N^{LIB}$ ). According to neoclassical economic theory, these coefficients should all be zero because all changes in wages should go through changes in prices of outputs and the interest rate. However, for example, the coefficient on

being in Taiwan for an additional year after 1987 was -6% per year and significant at the 5% level of confidence (column 2 of Table 6).

We also include a specification in which we allow for individual post-liberalization-year effects in Taiwan (column 3 in Table 6) rather than constraining the effect of an additional year after the liberalization in Taiwan to be the same across years. We find a -8% and significant impact from the year 1987 and increasing impacts not significantly different from -32.8% for the following years.

As a robustness check, we ran fixed effects regressions (with both constrained linear time effects (column 4 in Table 6) as well as individual country year effects for after 1987 (column 4)) which constrained individual fixed effects to be the same across industries within a year. Thus, we essentially looked at the cross-country industry year wage differentials and how they changed as a function of price differentials, interest rate differentials, differentials in gross fixed capital formation, alternative wage differentials, and unemployment differentials. Our findings are relatively similar. We get a -5.1% effect of being in Taiwan for every year after the liberalization.

Lastly, we ran a fixed effects regression where we allowed for individual country year effects after 1987. We found approximately a -26% decline in wages correlated with the Taiwan liberalization.

## V. Future Extensions

### Unions/Tradables

Our interpretation of the large negative impact of the capital market liberalization upon Taiwanese manufacturing wages is that it represents losses in worker's wages due to threats of relocation. These are changes in wages which do not go through prices so that they are deviations from the competitive labor market story. At the minimum, our results call into question the competitiveness of labor markets. Nevertheless, it is possible to get other types of deviations from the relationships between prices and wages which are not bargaining threat effects. To further support the notion that these liberalization-correlated changes in wages in fact do represent shifts in bargaining power, we look to see whether (1.) Taiwanese industries with a higher unionization rate and (2.) Taiwanese tradable goods industries are effected more by the liberalization. If highly unionized sectors were effected more than less unionized sectors, this gives greater credence to the bargaining threat effect. Also, if non-tradable industries are not as effected as tradable industries, since non-tradable industries (such as restaurants) are not as able to threaten with relocation to other countries since the importation costs would be prohibitive., then non-tradables should be lese-affected by watching a movie instead. In the next version of this paper, we hope to report the results of the two above regressions.

### Cross-Country Policy Regressions

So far in this paper, our empirical approach in this paper has been to make the identifying assumption that the only basic systematic (non-random) differences between

Korea and Taiwan are captured through things is that Taiwan had different goods prices in manufacturing, different interest rates, different capital investment levels by industry, different options outside of manufacturing for employment, different cyclical conditions (as measured through unemployment), and different timings of capital market liberalization. All other differences between the two countries are taken to be random and this is precisely what allows us to numerically assess the impact of capital market liberalization in Taiwan. One large criticism of this approach is that many other changes were occurring at the same time and the regressions might be picking up the effects of these other changes. For example, Taiwan underwent arge securities and exchange law redefinition and in doing so radically increased the ability of investors to both trade and create firms. Implicitly we are assuming these changes did not effect the time path of wages in Taiwan relative to Korea. To the credit of the framework we have adopted for the first half of the paper, before deciding to use Taiwan and South Korea as a country pair, we compared the two countries on a whole range of macroeconomic variables while also looking at institutional details. Nevertheless, these identifying assumptions are somewhat strong. In particular, the possibility of other policy changes having an impact upon differential wages paths lessens the credibility of the regressions. This is an especially acute criticism given the fact that often times, liberalizations are undertaken as a part of a large shift in government policy.

## **VI. Conclusion**

This paper has had a few goals in its creation. The first is to explore the effects of capital market liberalization upon wages. Our preliminary results seem to suggest

that effects of capital market liberalization are strong and negative. In addition, we specifically have hoped to isolate the effect of liberalization which does not go through prices or capital investment. We interpret this residual change in wages as the threat effect from the increased mobility in capital. There are a few main problems with this interpretation : (1.) were there other things, such as the change in presidential regime in Korea and resulting labor disturbances that could also account for the differences across countries? and (2.) we are concerned about output prices, the interest rate and gross fixed capital formation. Some of this endogeneity is controlled for in the panel regression (the endogenous component which is correlated perfectly across countries within an industry). Some of this skepticism will be diluted upon running IV estimation and upon trying an alternative cross-country approach. Nevertheless, the main story of differential wage growth in Taiwan and South Korea not explainable through neoclassical mechanisms and most likely explainable through bargaining losses due to threat effects seems to hold up.

A second goal in this paper was to present some ideas on capital market liberalization and its effects upon wages. We believe that this portion of our paper added insight into the theoretical mechanisms through which capital market liberalizations may affect wages via bargaining threats.

Lastly, a third goal was to use a pluralism of econometric approaches in this paper rather than just one approach. This will be achieved in the next version of our paper. We believe that our current results are suggestive of the possibility that threat effects may have a large and dampening effect upon wages. We believe that additional



research in this field is necessary, specifically geared towards research investigating the impact of capital market liberalization upon wages for a much wider group of countries. Our preliminary impressions from our results are that liberalization of capital markets can have large negative effects upon the wages of workers. We believe that our results are suggestive of impacts over the past 30 years on the order of magnitude to explain a decently large percentage of the world-wide increase in inequality. We hope that this paper will spur on future empirical as well as theoretical research in an understudied area which we feel to be both fascinating and important.

## Appendix 1. Tables

**Table 1. Population (000s)**

	<b>Korea</b>	<b>Taiwan</b>
<b>1981</b>	38,723	18,136
<b>1982</b>	39,326	18,458
<b>1983</b>	39,910	18,733
<b>1984</b>	40,406	19,013
<b>1985</b>	40,806	19,258
<b>1986</b>	41,184	19,455
<b>1987</b>	41,575	19,673
<b>1988</b>	41,975	19,904
<b>1989</b>	42,380	20,101
<b>1990</b>	42,869	20,353

**Table 2. GDP Per Capita (Laspeyres Index; 1985 Constant Dollars)**

	<b>Korea</b>	<b>Taiwan</b>
<b>1981</b>	3,212	4,593
<b>1982</b>	3,395	4,642
<b>1983</b>	3,712	4,903
<b>1984</b>	4,005	5,295
<b>1985</b>	4,217	5,449
<b>1986</b>	4,622	5,901
<b>1987</b>	5,080	6,598
<b>1988</b>	5,606	7,166
<b>1989</b>	6,090	7,722
<b>1990</b>	6,665	8,067

**Table 3. Government Share of GDP (1985 International Prices)**

	<b>Korea</b>	<b>Taiwan</b>
<b>1981</b>	11.3	14.7
<b>1982</b>	10.6	15.2
<b>1983</b>	9.9	14.8
<b>1984</b>	9.2	14.6
<b>1985</b>	9.1	14.9
<b>1986</b>	9.1	14.1
<b>1987</b>	8.8	13.6
<b>1988</b>	8.6	13.5
<b>1989</b>	8.6	13.8
<b>1990</b>	8.5	14.8

**Table 4. Investment Share of GDP (1985 International Prices)**

	<b>Korea</b>	<b>Taiwan</b>
<b>1981</b>	27	27.9
<b>1982</b>	27.1	24.8
<b>1983</b>	27.8	23.7
<b>1984</b>	29.2	22.8
<b>1985</b>	28.5	19.9
<b>1986</b>	28.6	19.2
<b>1987</b>	30.3	22.2
<b>1988</b>	31.4	24.6
<b>1989</b>	34.6	23.8
<b>1990</b>	36.9	23.1

**Table 5. Trade (Exports + Imports) as a % of GDP**

	<b>Korea</b>	<b>Taiwan</b>
<b>1981</b>	78.06	101.78
<b>1982</b>	71.52	95.15
<b>1983</b>	71.74	97.45
<b>1984</b>	71.81	101.31
<b>1985</b>	67.86	94.62
<b>1986</b>	71.08	96.51
<b>1987</b>	75.09	97.71
<b>1988</b>	71.64	98.51
<b>1989</b>	65.45	92.85
<b>1990</b>	62.48	89.88

**Table 6. Regression Results**

	Specification				
	(1)	(2)	(3)	(4)	(5)
<i>Constant</i>	6.283*** (0.406)	-5.470*** (1.265)	-5.397*** (1.300)	9.795*** (3.299)	10.426** (4.185)
<i>Ln price</i>		0.243** (0.088)	0.242** (0.088)	0.164*** (0.049)	0.163*** (0.049)
<i>Real int rate</i>		-0.000 (0.007)	-0.001 (0.008)	0.002 (0.007)	-0.001 (0.011)
<i>Ln alt wage</i>		1.492*** (0.143)	1.486*** (0.147)	-0.0216*** (0.382)	-0.287 (0.483)
<i>Unemployment</i>		-0.090** (0.035)	-0.093** (0.036)	-0.034 (0.022)	-0.029 (0.483)
<i>Ln capital formation</i>		0.020 (0.011)	0.021 (0.011)	0.004 (0.011)	0.004 (0.007)
$\delta^{TAI}$	-0.197*** (0.050)	0.055 (0.078)	0.052 (0.078)	-0.203** (0.079)	-0.203 (0.104)
$\delta^{AFTER}$	0.670*** (0.041)	0.041 (0.075)	0.036 (0.075)		0.036 (0.075)
$\delta^{TAI} * \delta^{AFTER}$	-0.502*** (0.084)	-0.042 (0.098)	-0.328*** (0.084)	-0.004 (0.060)	-0.257*** (0.070)
$N^{LIB}$	0.114*** (0.021)	-0.061** (0.027)		-0.051** (0.022)	
<i>Tai87</i>			0.245** (0.109)		0.186 (0.107)
<i>Tai88</i>			0.157 (0.106)		0.152 (0.087)
<i>Tai89</i>			0.073 (0.086)		0.081 (0.053)
<i>Tai90</i>			0.054 (0.077)		0.073 (0.041)
$R^2$	0.641	0.764	0.764	Within: 0.804 Between: 0.630	Within: 0.804 Between: 0.630

## Appendix 2. Figures

Figure 1. Worldwide Foreign Direct Investment as a % of GDP, 1970-1997

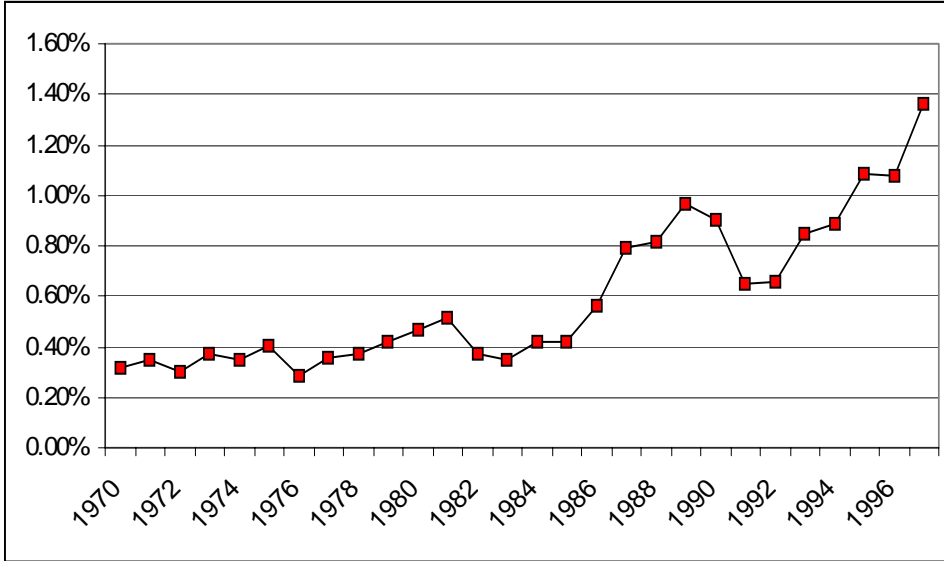


Figure 2. Direct Outward Investment, Taiwan and Korea, 1981-1991 (US\$000)

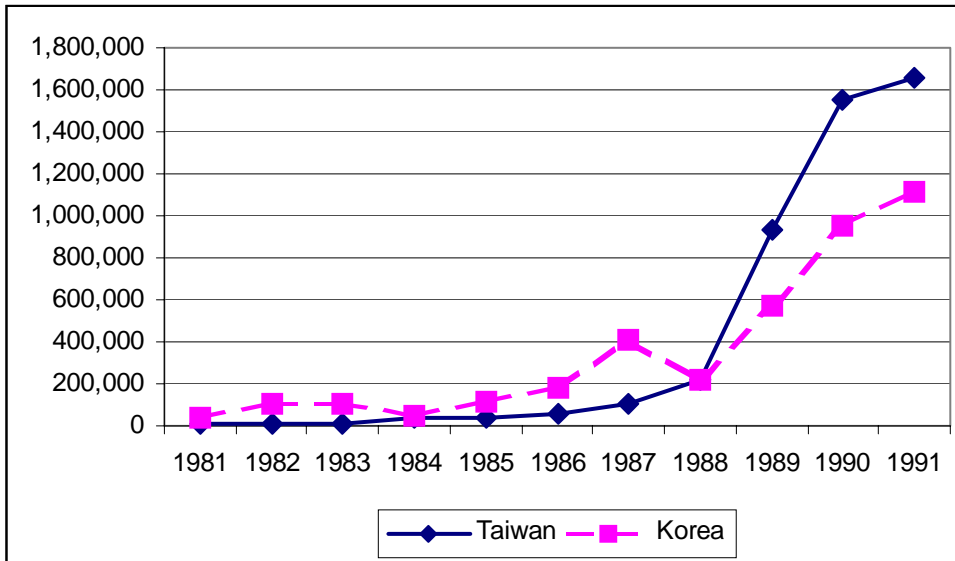


Figure 4. Unemployment Rate, Taiwan and Korea, 1981-1991 (%)

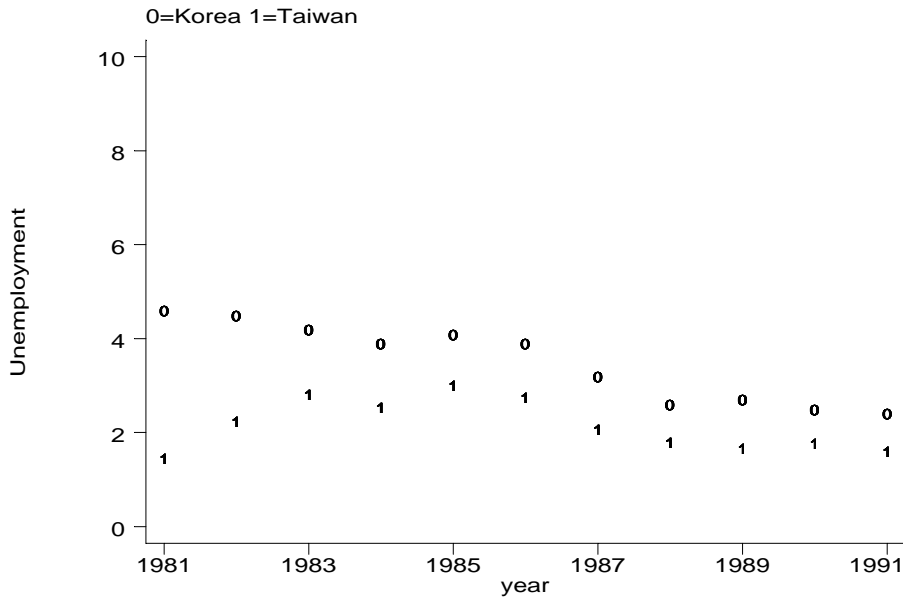


Figure 5. Consumer Price Index, Taiwan and Korea, 1981-1991 (1981=1)

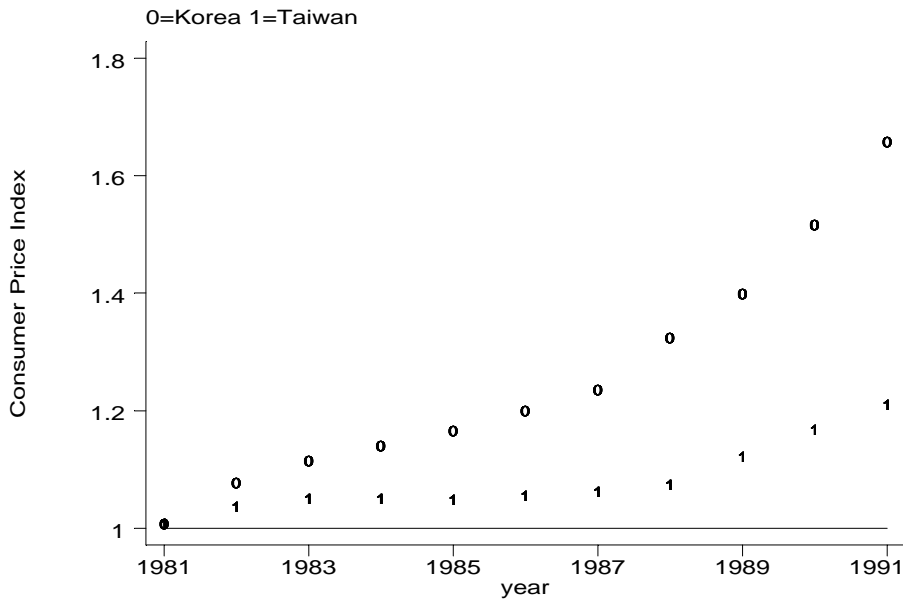


Figure 6. Producer Price Index, Taiwan and Korea, 1981-1991 (1981=1)

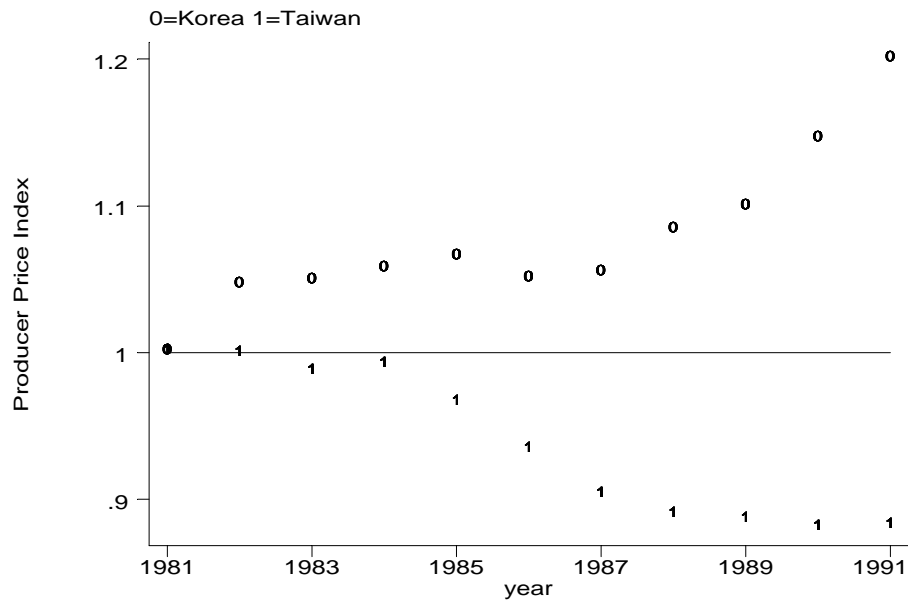


Figure 7. Aggregate Gross Fixed Capital Formation in Manufacturing, Taiwan and Korea, 1981-1991 (1981 US\$)

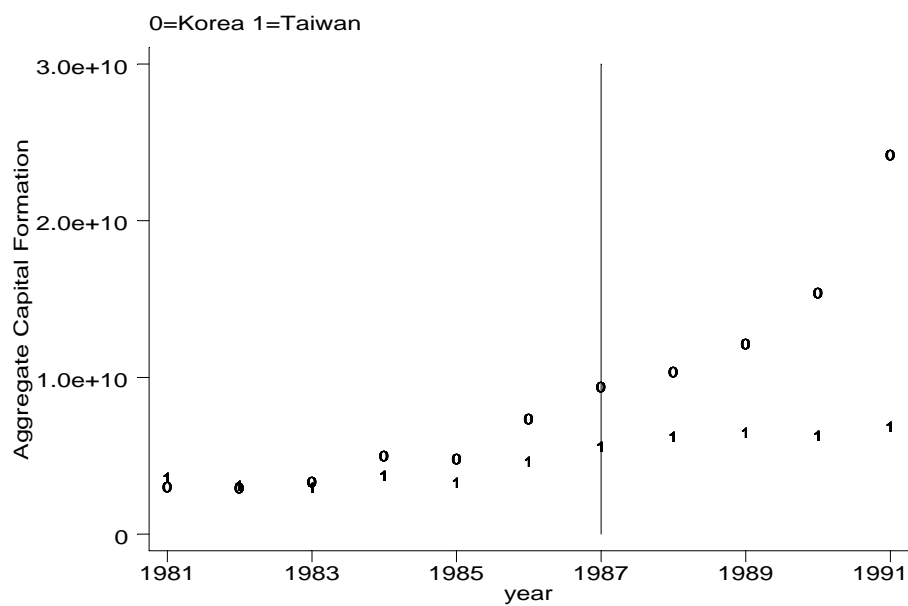
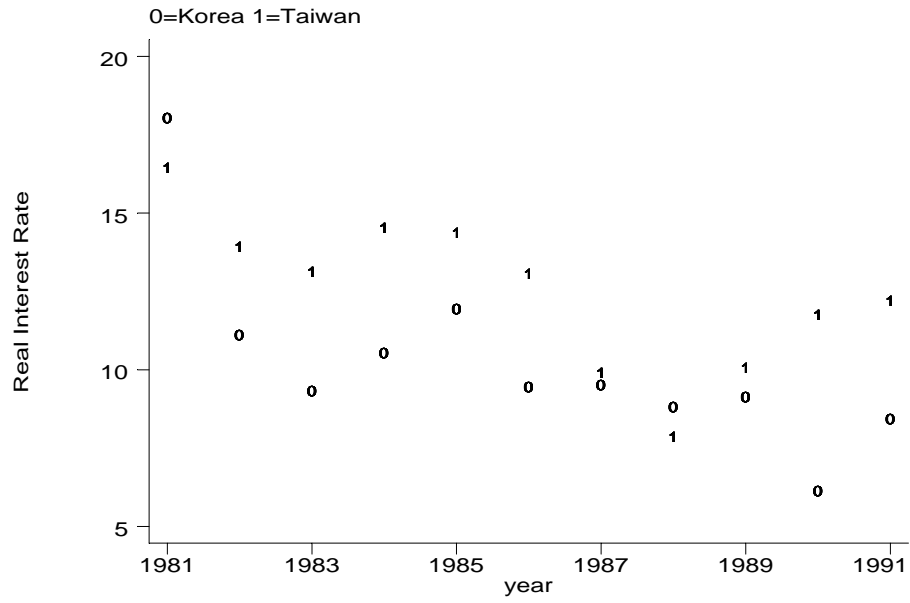




Figure 8. Real Interest Rate (%), Taiwan and Korea, 1981-1991



### Appendix 3. Data Sources and Definitions

We obtained 3-digit level ISIC code data on aggregate monthly wages and salaries, value of output and number of employees for both Korea and Taiwan for the period 1981-1991 from the United Nations Industrial Development Organization (UNIDO) INDSTAT3 database. We also obtained gross fixed capital formation data for Korea from 1981-1991 from INDSTAT3. Taiwanese gross fixed capital formation data was provided by the Directorate-General of Budget, Accounting and Statistics of the Taiwanese government.

From the *Korea Statistical Yearbook*, we obtained data on unemployment rates, inward and outward direct investment, producer prices, Won/Dollar exchange rates, consumer price index, producer price index and the alternative wage (hotel and restaurant industry). Interest rate data were obtained from the International Monetary Fund's *International Financial Statistics* CD-ROM. The interest rate series chosen was the minimum rate charged by money deposit banks to business enterprises for loans up to one year.

From the *Statistical Yearbook of the Republic of China* we obtained data on unemployment rates, producer prices, New Taiwan Dollar/US Dollar exchange rates, consumer price index, producer price index and the alternative wage (hotel and restaurant industry). Data on inward and outward direct investment were obtained from the *Taiwan Statistical Data Book* (1999) of the Council for Economic Planning and Development, ROC.

### *Industry Categories*

The following is listing of the 2-, 3- and 4-digit ISIC code industries that make up our 15 manufacturing industry groupings:

Industry Category	ISIC Codes Included
1	311, 313, 314
2	321
3	322
4	323
5	331, 332
6	34
7	351, 352
8	355, 356
9	36
10	37
11	381
12	382
13	3831, 3832
14	384
15	385

The following data was aggregated together into industry groups:

- ***Korea:*** Producer prices indices from 311, 313, and 314, from 331 and 332, and from 3831 and 3832 were aggregated into groups 1, 5 and 13, respectively, using value of output as weights.
- ***Taiwan:*** gross fixed capital formation data from 311/313 and 314, from 351 and 352 and from 355 and 356 were added together to form industry groups 1, 7 and 8, respectively.

## Bibliography

- Angrist, Joshua and Alan Krueger, "Empirical Strategies in Labor Economics" in the *Handbook of Labor Economics*, Vol. 3A, Orley Ashenfelter and David Card, editors, Amsterdam : Elsevier Science.
- Bronfenbrenner, Kate (1996), "The Effects of Plant Closing or the Threat of Plant Closing on the Right of Workers to Organize." Mimeo: Cornell University.
- Card, David and Alan Krueger (1994), "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania", *American Economic Review*, Vol. 84, No. 4 (Sept.), 772-793
- Dube, Arindrajit and Sanjay Reddy (2000), "Capital Mobility, Trade Liberalization and Relocation Threats: The Bargaining Channel and the Distribution of Income", Mimeo: Harvard University, June.
- Krueger, Alan (1999), "Experimental Estimates of Education Production Functions.", *Quarterly Journal of Economics*, Vol. 114, No.2 (May), 497-532.
- Reventa, Ana (1992), "Exporting Jobs?: The Impact of Import Competition on Employment and Wages in U.S. Manufacturing", *Quarterly Journal of Economics*, Vol. 107, No. 1 (Feb.), 255-284.
- Rodrik, Dani (1999), "Do Democracies Pay Higher Wages?", *Quarterly Journal of Economics*, Vol. 114, No. 3 (Aug.), 707-38.
- Rodrik, Dani (1997), *Has Globalization Gone Too Far?* Washington, D.C.: Institute for International Economics.
- Semkow, Brian Wallace (1994), *Taiwan's Capital Market Reforms: The Financial and Legal Issues*. Oxford, UK: Oxford University Press.
- (1992), *Taiwan's Financial Markets and Institutions: The Legal and Financial Issues of Deregulation and Internationalization*, Westport, CT: Quorum Books.
- Slaughter, Matthew (1993), "Trade and U.S. Wages: Great Sucking Sound or Small Hiccup!", *Brookings Papers on Economic Activity: Microeconomics 1993*, Vol. 0 (0), 161-210

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