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April 2011

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April 2011

8th Midwest International Economic Development Conference

Keywords – price transmission, market integration, inflation, Vietnam

JEL classification: F13, F14, O24, O53,

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* Corresponding author. Thanks are due to participants in CIEM seminars in July, 2009 and in June, 2010 in Hanoi, who commented on this research while it was in progress. Responsibility for the content of this paper remains with the authors.

Transmission of World Prices to the Domestic Market in Vietnam

Abstract

During the past two decades Vietnam has witnessed increasing engagement with the world market, achieved through entry into numerous international trading agreements, altered border policies, institutional reforms, and relaxation of controls on foreign investment. These endeavors have been repaid with rapid GDP growth, expanding trade, and increasing foreign investment. High rates of inflation have also accompanied the development process at times, especially in recent years after Vietnam joined the WTO.

This study explored how these two macroeconomic phenomena -- increasing world market integration and inflation -- impact domestic prices. Specifically, the degree to which the world price changes are transmitted into the domestic market and the level of sectoral inflation pass-through are investigated. Model specifications include the most basic form which only contains world price as the independent variable, level regression models with world price and inflation as independent variables, and error correction models with and without an inflation term. Three alternative model specifications were estimated to test for the effects of home goods, wages, and trade policy interventions on world price transmission. With price and tariff data from General Statistics Office of Vietnam (2009), inflation and real exchange rate data from IMF (2010), and wage data from the Economist (2010), models were estimated at three levels of sectoral aggregation for the period from 1999 to 2008.

We found that large sectoral variation exists in world price transmission. Panel regressions at 5-sector aggregation level (agriculture export, agriculture import, manufacturing export, manufacturing import, and energy sectors) are unable to adequately represent the transmission mechanisms of individual sectors in each group. Twenty-four sector aggregation results are dominated by the largest sector, so estimates are not able to represent individual sectors within an aggregated group. Sectoral regressions at an 87-sector aggregation level are needed to avoid generating biased estimates due to aggregation that will be fed into models for trade policy analysis.

The sectoral regression results show that price transmission elasticities (θ_k) are both significantly different from zero and significantly different from one for most sectors, indicating that the price transmission is present but imperfect for most sectors. Fourteen out of 87 sectors are defined as well-integrated sectors, having transmission coefficients significantly different from zero but not significantly different from one (based on the estimation results for the error correction model with an inflation term). Thirty out of 87 sectors are defined as segmented sectors, having transmission coefficients significantly different from one but not significantly different from zero, or having an incorrectly signed transmission coefficient. All sectors except for the manufacturing export sectors exhibit a higher percentage of sectors classified as segmented than integrated. Manufacturing export sectors have the largest proportion of sectors classified as integrated.

Half of the 14 integrated sectors have a significant speed-of-adjustment parameter estimates (γ_k) in the error correction model, which is exceptional among all sectors. For 67 sectors the speed of adjustment term is insignificant. This finding suggests that well integrated sectors tend to eliminate the differentials between domestic and world prices relatively quickly. Insignificant speed-of-adjustment parameters contradict the proposition of long-run convergence to LOP in those cases. Thus, price transmission is often low in the long run as well as the short run.

The effect of inflation is also measured in the models. The results show clearly non-neutral inflation pass-through for 12 sectors, which is indicated by the deviation of the inflation parameter (α_k) from unity, when the transmission coefficient (θ_k) is insignificant. Despite the variation across sectors, two regularities can be found regarding inflation effects. First, inflation has a strong positive impact on domestic prices for most sectors. Second, inflation is better at explaining the variation of domestic prices than are world prices, which is again consistent with the fact that the connection between domestic and world prices remains limited for most sectors. The price transmission elasticities are much lower when inflation is included, indicating that inflation picks up much of the information that is useful in explaining the variation of domestic prices.

Alternative specifications allowed us to conclude that the CPI better explains prices than wages, suggesting that demand-pull inflation is more important than cost-push inflation. The

divergence from LOP seems not due to home goods effects, suggested by the insignificance of the real exchange rate as an explainer of prices. Stabilization policy at the border also seems not to be a significant factor, as tariff effects were measured and not found to significantly explain the degree of price transmission.

To do trade policy analysis correctly, a disaggregated approach is required, and careful attention must be paid to how inflation impacts the economy. More research is called for on the relationship between an open Vietnamese economy and the mechanisms of inflation determination, which appear to be more important than world price transmission or exchange rate pass-through.

1. Introduction

Numerous studies have attempted to predict the consequences of Vietnam's accession to the World Trade Organization (WTO) in 2007 (Rama and Sa, 2005; Abbott, Bentzen and Tarp, 2010). Studies have subsequently sought to understand the impact WTO accession has had on Vietnam, after the fact, and have been used earlier to explore more broadly the apparently strong links between trade policy and Vietnam's rapid economic development (Abbott, Boys, Huong and Tarp, 2009; Abbott, Wu and Tarp, 2010). While trade policy includes much more than just tariff changes (e.g. institutional reform, market access openings, and incentives to foreign investment), modeling efforts typically focus on changes in tariff commitments, at least as one important mechanism to study, and so rely on strong linkages between world prices and domestic prices.[1] A key premise of most trade policy analysis is that price signals are transmitted spatially and across borders. The simplest assumption invoked is the small country assumption, or that world prices are fixed and domestic prices are determined by those world prices, tariffs, exchange rates and transactions costs according to the Law of One Price (LOP). This assumption corresponds with perfect transmission of world prices to border prices.

Perfect transmission of price shocks between two points in space indicates the presence of frictionless markets that allows for efficient arbitrage. Absence of price transmission challenges the existence of a well-integrated market, and the relevance of the small country assumption. Price transmission may be imperfect because markets are segmented, or because trade policy interventions block transmission of world prices to the domestic market. For example, a variable levy regime would alter tariffs as world prices change, stabilizing domestic prices in the face of volatile world prices. With data on both world prices and tariffs as well as on domestic prices, price transmission modeling may be used to measure both the extent of market integration and the use of trade policy to stabilize and so block price transmission. The degree to which price signals have been transmitted from one point to another offers a broad assessment of market integration when tariff changes are taken into account. Moreover, price transmission is at the heart of any meaningful quantification of the impact of policy reforms. By building the

[1] Abbott, Wu and Tarp (2010) argue that investment linkages, particularly incentives to foreign investment, and market access opportunities are much more important than tariff changes in determining trade policy impacts in Vietnam. Tariff changes are much easier to model, however.

estimates of price transmission elasticities[2] into partial or general equilibrium models, the extent to which the policy can pass-through across borders can therefore be measured.

Imperfect price transmission has been found in a number of settings worldwide. Limited exchange rate pass-through (Knetter, 1995), pricing to market (Krugman, 1987), high transactions costs (Anderson and Wincoop, 2004), border interventions and product differentiation can all give rise to imperfect price transmission.

Casual observation suggests that sectoral domestic and international prices in Vietnam live lives of their own, and are not highly correlated. For the 87 tradable sectors among the 112 sector aggregation typically used by GSO, the average correlation between domestic prices and border prices (measured in home currency with tariffs included) is only 0.48 for import prices, and rises to only 0.63 for export prices. Moreover, this very imperfect correlation appears to occur using world prices that either include or exclude tariffs. This implies that domestic markets are not perfectly integrated with world markets and that tariff and world price changes are not fully transmitted to domestic prices. In this paper we attempt to explore these price relationships more formally, using estimation of price transmission models.

Inflation may be a more important factor determining domestic prices. The correlation between the CPI for Vietnam and sectoral prices is much higher, at 0.92, than the correlation between border and domestic prices. Moreover, while inflation had been brought under control in the mid 1990s, and kept at levels below 10 percent per year, high inflation re-emerged 2008, reaching 23% (IMF, 2010). This inflation has been related by some to WTO accession and the current account deficit experience in that year. The worldwide "great recession" and collapse of world trade brought inflation in Vietnam back down to 7% in 2009, but it may again exceed 10% in 2010 (Economist, 2010). Thus, broad trade and foreign capital flow effects on inflation may be the mechanism by which trade policy affects domestic prices.

The importance of price transmission elasticities on trade policy analysis for Vietnam was explored in Abbott, Wu, and Tarp (2010). They concluded that the effects of trade policies, such as tariff cuts, are muted considerably when the imperfect price transmission elasticities are

[2] The price transmission elasticity is essentially $\partial Pd/\partial Pw * (Pw/Pd)$ where Pw is the world price and Pd is the domestic price. This may be measured before or after tariffs and exchange rates are applied to Pw.

used. For instance, the impact of tariff cuts on total imports assuming imperfect price transmission is about three quarters of the effect when full transmission is assumed. Detailed changes in sectoral trade and the impact on GDP are even smaller from assuming imperfect price transmission. They were concerned with the estimated low degree of price transmission, however, that was found using a pooling strategy for broad categories of goods. That concern motivated this effort to explore further the extent of price transmission in Vietnam.

Many trade policy analyses do not use price transmission modeling. While many studies invoke the small country assumption, CGE models in fact do not ignore this issue. They use a different approach, assuming domestic and imported goods are imperfect substitutes. In order to determine how tariff reductions are translated into market access improvements, an Armington or CES model is employed. Two levels of imperfect substitution are typically assumed – substitution across import suppliers (the original Armington model) and substitution between domestic and foreign goods – and a substitution elasticity must be established for each level. Historically, the values of the Armington substitution elasticities are simply assumed (Abbott, Bentzen, and Tarp, 2009). Some recent efforts have estimated substitution across import suppliers, but it is rare to estimate the foreign-domestic substitution elasticity. This latter parameter is key to capturing imperfect price transmission, if in an indirect way, and the relatively large values typically assumed would not allow for substantial degree of imperfect transmission. In studies that assume a price transmission structure, the values of price transmission elasticities are often not derived from econometric estimations, as well. Therefore, the predictions of market access under trade policy reforms following these approaches are unlikely to be accurate, and the impacts of tariff changes are likely to be overestimated. In any case, estimation of the degree of price transmission will shed light on the importance of this issue.

The aim of this paper is to provide estimates of price transmission from the world market to the domestic market in sectors encompassing the tradable portion of the Vietnamese economy. The results can be employed *per se*, and support further analytical efforts, particularly in the field of trade policy analysis. This work relies heavily on the investment, trade and price database obtained from the General Statistics Office (GSO) of Vietnam. Those data are also supplemented with macroeconomic information extracted from the International Monetary Fund (IMF). Annual price and inflation data are analyzed by testing for the Law of One Price (LOP) and exploring

neutral inflation pass-through. Three alternative model specifications are estimated to test for possible alternate explanations for deviations from the LOP. The empirical results suggest wide sectoral variation, imperfect price transmission, non-neutral inflation pass-through, the dominant effect of inflation on domestic price variation, and low speed of adjustment to the Law of One Price. While disaggregation results in apparently greater price transmission than was found when pooling sectors, inflation is found to be a better explainer of domestic prices in Vietnam.

The remainder of the paper is structured as follows. The next section describes key economic events related to two important facets, world market integration and inflation, that directly affect Vietnamese domestic prices. Section 3 briefly summarizes relevant developments in the estimation of price transmission. Section 4 lays out the specifications of alternative models employed to analyze the data. Section 5 discusses data sources and various aggregation strategies. Estimation results and hypothesis tests on market integration or segmentation, dynamic adjustment to LOP, and inflation neutrality are presented in Section 6. Section 7 summarizes and concludes.

2. World Market Integration and Inflation

2.1. World Market Integration

The introduction in 1986 of *doi moi* ushered in a long period of transformation of Vietnam from a centrally planned to a market economy. One of the core principles of the gradualist reform process was the movement towards export-led economic growth. The renovation process embodied partial liberalization of controls on foreign investment and international trade, foreign exchange market reforms, and shifting to a more market determined exchange rate system (CIE, 1998). Private companies were first permitted to engage directly in trade in 1990-91. In 1998 the Ministry of Trade removed the requirement of licensing imports. During the same time period various controls on foreign investment were phased out.

Vietnam joined a number of regional and multilateral trading arrangements in the 1990s and 2000s. In 1992 Vietnam signed a preferential trade agreement with the European Economic Community (now EU). In 1995 Vietnam became a member of the ASEAN Free Trade Area

(AFTA). In 1998 Vietnam joined the Asia-Pacific Economic Cooperation (APEC) group. Vietnam signed a Most Favored Nation (MFN) agreement with Japan in 1999 and a similar bilateral trade agreement (BTA) with the United States in 2000. Thanh (2005) indicated that Vietnam had negotiated over 100 bilateral trade agreements by 2002. In 2007 WTO accession by Vietnam was officially granted, which culminated a long process of efforts to integrate the Vietnamese economy into international markets (Abbott, Bentzen and Tarp, 2009).

The outward-oriented policy reforms have generated tremendous impact on the Vietnamese economy. As shown in Figure 1, the policy reform process has been associated with rapid increase in trade (exports plus imports as a share of GDP), from 62% in 1990 to 97% already in 1998 and to 173% in 2008. Growth in exports has been impressive, from 26% of GDP in 1990 to 45% in 1998 and to 78% in 2008 (IMF, 2010). Furthermore, the share of imports has been rising at a lower rate than exports, and yet imports continue to exceed exports.

WTO and bilateral agreement reforms in conjunction with the development of institutional and legal reforms attracted more capitals flowing into Vietnam (Abbott, Boys, Huong, and Tarp, 2008). Since the *doi moi* reform, Vietnam has seen a rapid rise in total investment and inflows of foreign capital. The percentage of gross capital formation in GDP doubled in 10 years since *doi moi*, from 14% in 1986 to 28% in 1996, and the number was more than tripled by 2007 to 43% (World Bank, 2010). Registered foreign capital increased quickly in the first 10 years after *doi moi*. The growth rate of registered capital reached 54% in 1989, further increased to 76% in 1991, and remained at above 40% in the 1990s prior to the Asian Financial Crisis. Except for a temporary phase of decrease in 1997, 1999 and 2002, registered foreign capital has been increasing at a double-digit rate in almost every year since 1990. The growth rate surged to 76% in 2006 and 78% in 2007 (GSO, 2010) as WTO accession was anticipated and implemented.

Increases in export earnings, private remittances and FDI have fuelled domestic demand, resulting in the rise in output as well as in inflation (IMF, 2009). The GDP growth rate increased from 5.1% in 1990 to 8.7% in 1992, and remained above 8% until 1998. As the Asian Financial Crisis gripped much of Asia, the GDP growth rate in Vietnam fell to 5.8% in 1998 and 4.8% in 1999. However, the recovery of the Vietnamese economy was fast and stable. The GDP growth rate reached 6.8% in 2000, increased to 7.1% in 2002 and to 8.4% in 2005, and remained at

about that level until 2008. The GDP rate growth fell to 6.3% in 2008 and further to 5.3% in 2009 due to the world economic recession and the collapse of global trade (IMF, 2010).

Vietnam has set out and accelerated its pace on the road toward international economic integration. Trade and investment policy reforms in principle have cleared many barriers that might block the connection between the domestic market and international market. This was achieved not only through tariff reduction, but also through developments of institutions and laws that support an outward-oriented development strategy. The reformed market and legal institutions brought market access opportunities, a surge in investment and massive foreign capital inflows.

2.2. Inflation

Figure 2 shows the evolution of inflation over the period 1986-2010. The first three years after *doi moi* were characterized by hyperinflation, with the annual growth rate of the consumer price index (CPI) averaging 366%. The CPI annual growth rate declined to 38% in 1992. From 1993 to 2007 the inflation rate had been less than 10%, except for 1995. However, the annual inflation rate sharply rose to double digits (23%) in 2008, one year after WTO accession. Inflation has rapidly decelerated to 7% in 2009 owing to lower world commodity prices and relatively slow domestic economic growth as the global recession began. Nevertheless, inflationary expectations have yet to be quelled, and the rise in CPI is expected to surpass 10% again in 2010 (Economist, 2010).

The GDP deflator and CPI have been growing at a higher rate in comparison with unit labor costs (ULC), suggesting that higher labor cost is not the sole contributor to inflation. The differences are very sharp in certain years. For example, in 1994 the growth rate of the GDP deflator was 50 times the growth rate of the ULC. ULC also changed at a much lower speed than the average nominal wage index, implying increasing labor productivity since 1986. The ratio between the average growth rate of the average nominal wage and average growth rate of the ULC was 9:1 over the period 1990-2010. Dividing the average nominal wage index by the ULC

approximately yields productivity measured by output per hour. Labor productivity in 2010 is 11 times of that in 1990. Even though the CPI and GDP deflator have been moving in tandem, the relative speed of change varies over time. CPI set out at a lower speed, and then outstripped the GDP deflator occasionally (in 1991 and 1992) prior to 2005. Since 2005, the CPI has been growing faster than the GDP deflator. Consumers have experienced more intensive inflationary pressure than the economy as a whole in recent years. Moreover, the discordance between CPI and GDP deflator hints that different sectors producing different commodities may experience different levels of inflationary pressure.

In summary, in the recent two decades Vietnam has witnessed increasing engagement into the world economy. Both investment and trade policy reforms have fuelled that process. Meanwhile, inflation has plagued Vietnam's economy from time to time, causing fluctuating and rising domestic prices. Particularly since Vietnam's accession to the WTO in 2007, rapid credit growth caused by massive capital inflows, combined with higher government spending and a rise in energy and food prices, led to high inflation (IMF, 2009). The two macroeconomic activities are closely linked to Vietnam's domestic prices.

Economic principles suggest that perfect market integration corresponds with full price transmission. Moreover, use of nominal exchange rates should capture inflation differentials. However, the phenomenon of imperfect price transmission widely exists despite evidence of superficial market interconnections.

The inflation rate measures overall domestic price changes, but can at best capture only the mean level. Asymmetric price changes and non-neutral inflation across sectors disables the attempt to obtain a holistic view about price change from a single inflation indicator. The price transmission models in this study utilize the two major components of domestic price determinants, namely world market forces and domestic market forces, to disassemble domestic price variation, and also enable us to investigate the extent to which the world price is transmitted to domestic price. We will also assess the sectoral distribution of inflation within the unique context of Vietnam. Before the models are presented, developments of estimation techniques for price transmission modeling are briefly surveyed in the next section.

3. Price Transmission Analysis

Price transmission analysis studies how price signals are transmitted between markets. If two spatially distinct markets are integrated, then a shock to the price in one market should manifest in the price of the other market as well. Perfect price transmission occurs in well-functioning markets where the Law of One Price (LOP) holds. Price transmission may be blocked as a result of deliberate stabilization policy of the government through variations in trade policy instruments, or if poorly functioning markets or high transactions costs cause markets to be segmented. Price transmission models are used to capture the policy interventions, to measure the extent of market integration, and to test whether or not the LOP holds.

As evidenced by a substantial body of empirical work, the LOP is violated in many markets in many countries (e.g., Isard, 1977; Richardson, 1978; Giovannini, 1988; Knetter, 1995; Rogoff, Froot, and Kim, 2001; Alessandria, 2004). At least four groups of factors can contribute to the deviation of the domestic price from the world price, namely transportation and transaction costs, imperfect exchange rate pass-through, product differentiation, and border and domestic price policies (Conforti, 2004). To allow for integration, or arbitrage to occur between two markets, information and searching costs, negotiation costs, and monitoring and enforcement costs in addition to transportation cost need to be covered by price differentials (Dahlman, 1979). Full price transmission may appear to be violated if transportation and transactions costs are: 1) non-stationary, 2) fixed rather than proportional to traded quantities, or 3) multiplicative rather than additive (Conforti, 2004). Anderson and Wincoop (2004) argue that transactions cost in trade can be much larger than easily observed transportation costs.

In addition to transportation and transaction costs, incomplete exchange rate pass-through also leads to imperfect price transmission. One factor that may cause incomplete exchange rate pass-through is pricing–to-market, a model of imperfect competition. Pricing-to-market is a strategic pricing behavior such that a producer changes the relative price at which he sells his output abroad and at home (Atkeson and Burstein, 2008). A discrepancy may be generated between the domestic-currency price of the exports and the price of goods for domestic market, or even prices across export markets (Krugman, 1987; Marston, 1990). Another source of incomplete exchange rate pass-through is from the shifts in the marginal cost curve due to a changed exchange rate and thus changed imported input costs (Athukorala and Menon, 1994).

The third source of incomplete exchange rate pass-through is from the existence of non-tradables in total production, the prices of which do not adjust in response to an exchange rate change.

A third factor that affects price transmission is product differentiation. If home product and foreign imports are not homogeneous and the substitutability in consumption is not perfect, then the co-movement in prices may not be one-for-one. This possibility is what is explicitly modeled in many CGE models, and is represented by Armington functions. Aggregation of imperfect substitutes can give rise to apparently imperfect price transmission.

Another cause of imperfect price transmission is border and domestic price policies. Variable tariffs as stabilization tools were the original impetus to price transmission modeling in the agricultural economics literature. For example, Abbott (1979) estimated trade price elasticities for wheat and feed grains for both developing and developed countries based on the price transmission elasticities and the values of several other parameters to both show how government policy intervened and to build trade models that captured endogenous policy reactions to world prices. Bredahl, Meyers, and Collins (1979) emphasized the importance of the price transmission elasticity on the elasticity of export demand by computing export demand elasticities under various assumptions on the magnitude of price transmission elasticities. Non-tariff barriers such as sanitary and phyto-sanitary requirements, quotas, tariff-rate quotas, and domestic price support policies may also have strong effects on price transmission.

The earliest attempts to explore price transmission looked at correlation coefficients of two price series (Timmer et al., 1983; Stigler and Sherwin, 1985) or estimated the following linear regression (Isard, 1977; Richardson, 1978; Ardeni, 1989; Mundlak and Larson, 1992):

$$P_{it} = \mu + \beta P_{jt} + \varepsilon_t \tag{1}$$

where P_{it} and P_{jt} respectively denote the prices in domestic market *i* and world market *j* in time *t*. μ and β are parameters to be estimated, and ε_t is the error term. The null hypothesis that the prices in these two markets are integrated and transmission is perfect is:

$$H_0: \mu = 0 \; and \; \beta = 1$$

Model (1) is unable to grasp short-run dynamics explicitly. In order to reflect the nature of price stickiness, lags can be appended to model (1). For example, adding one lag gives:

$$P_{it} = \mu + \beta_1 P_{jt} + \beta_2 P_{it-1} + u_t \quad (2)$$

Time series approaches have become common in this type of analysis to better model dynamic processes (Baffes and Gardner, 2003). The error correction model (ECM) was developed for the purpose of describing both short-run dynamics and long-run equilibrium simultaneously in one model. The error correction term is defined as:

$$\varepsilon_t = P_{it} - \alpha - \beta P_{jt} \quad (3)$$

Then the error correction model can be written as:

$$\Delta P_{it} = \alpha + \gamma \varepsilon_t + \theta \Delta P_{jt} + u_t \quad (4)$$

This approach has the advantage of estimating using variables as first differences, so correcting for possible stationarity or serial correlation of data series. The economic interpretations of the parameters are as follows: β is the cointegrating coefficient, measuring the long-run relationship between prices in markets *i* and *j*. γ is referred to as speed-of-adjustment coefficient, indicating how much of the deviation from the long-run equilibrium can be eliminated in each time period. θ is referred to as the contemporaneous effect, gauging how much of a given change in price in market *j* can be transmitted into price in market *i* in the current time period. β is a long-run parameter, and γ and θ are short-run parameters. If γ is significantly different from zero, a dynamic process drives prices to converge in long run equilibrium, and so the LOP will hold in the long run if not in the short run.

More recent techniques adopted in price transmission analysis have been categorized into three hierarchies (Barrett, 1996). Level I methods (described above) only use price data. Level II methods combine price and transactions cost data. Level III methods combine price and trade flow data. Baulch's (1997) Parity Bounds Model (PBM) is a representative estimating approach employed in Level II studies, and recognizes possible non-linearity as trade regimes switch between importing and exporting. In addition, Balke and Fomby (1997) implicitly incorporate transfer costs by setting up thresholds on price differentials. The error correction process is switched on only when the price differential exceeds the critical threshold. Similar threshold modeling approaches are pursued by Hansen and Seo (2002), Seo (2003), Goodwin and Pigott (2001), Balcombe, Bailey and Brooks (2007), and Moser, Barrett, and Minten (2009).

The reliability of the results are highly contingent on the quality of the transaction cost data in PBM, which are notoriously difficult to measure, or on the accuracy of the algorithms that search for the critical thresholds in the other threshold models – which are data demanding.

The difficulty of quantifying transfer costs led to the development of Level III analysis. According to Barrett (1996), if one knows whether or not inter-market flows occurred, then the transfer margin is equal to the observed price differences. Thus, the demand for transfer cost data is obviated in Level III analysis. The observation of trade suggests market integration, yet the efficiency level of the market integration is unknown. Level III estimation methods use both price and trade flow data. Barrett and Li (2002) is an example of Level III analysis.

Level II and III analysis are most appropriate for narrowly defined, homogenous goods, where parity bounds driven regime switching is well defined, and trade reversals are observed. Due to the scarcity of transfer cost data and trade flow data at a disaggregated level, Level II Level III analyses have not been widely adopted in empirical studies despite their attractive theoretical foundation. Since Levels II and III analyses only target the inclusion of transfer costs, such tests may still be biased if other factors such as imperfect exchange rate pass-through, product differentiation, or border and domestic price policies are major causes of imperfect price transmission.

Due to lack of data on the transfer costs in Vietnam, we rejected Level II and Level III analysis. Reversal of trade flows is not common based on the sectoral trade flow data taken from GSO (2009). In fact, two-way trade is observed for the most disaggregated sectors, which is inconsistent with the base assumption of Level II and Level III analysis. The models we introduce below therefore follow the Level I testing approach, and consider the dynamic specifications found in Baffes and Gardner (2003).

4. Empirical Price Transmission Models

The LOP states that prices expressed in a common currency should be identical and no arbitrage profit should exist. If the LOP is valid for a given sector, then the domestic price should be equal to the world price, including tariff, transportation and transaction costs, converted to

local currency. The relationship between domestic and world prices under the LOP is formally written as:

$$P_{kt}^{d} = e_t^n P_{kt}^{w\prime}(1 + T_{kt})(1 + \tau_{kt}) \tag{5}$$

where P_{kt}^{d} denotes the domestic price for sector *k* in time *t*, $P_{kt}^{w\prime}$ denotes the world price expressed in foreign currency for sector *k* in time *t*, e_t^n denotes the nominal exchange rate in units of home currency per unit of foreign currency in time *t*, T_{kt} denotes the *ad valorem* tariff rate for sector *k* in time *t*, and τ_{kt} denotes transportation and transaction costs in trade for sector *k* in time *t*.

In addition, deflating the nominal exchange rate by relative price levels yields one measure of the real exchange rate. The converting rule between nominal and real exchange rates can be written as follows:

$$e_t^n = e_t^r * \frac{CPI_{Ht}}{CPI_{Ft}} \tag{6}$$

where e_t^r is the real exchange rate in time *t*, and CPI_{Ht} and CPI_{Ft} are consumer price indices in the home country and foreign country in time t, respectively. The ratio of the consumer price indices reflects relative inflation at home versus abroad.

Substituting (6) into (5) gives:

$$P_{kt}^{d} = (e_t^r * \frac{CPI_{Ht}}{CPI_{Ft}})P_{kt}^{w\prime}(1 + T_{kt})(1 + \tau_{kt}) = P_{kt}^{w}(1 + \tau_{kt}) \tag{7}$$

where $P_{kt}^{w} = (e_t^r * \frac{CPI_{Ht}}{CPI_{Ft}})P_{kt}^{w\prime}(1 + T_{kt})$ denotes the tariff-inclusive world price, measured in home currency.

The adoption of Level I analysis implicitly assumes that the variations in transportation and transaction costs over the time period only have negligible impact on domestic price variation. They will be captured in the error term of a regression on this relationship. Thus, the relationship between domestic and world prices under LOP is simplified as:

$$P_{kt}^{d} = \theta_k P_{kt}^{w} + \varepsilon_{kt} \tag{8}$$

where ε_{kt} is the error term and $\theta_k = 1$ if the LOP holds. This relationship uses the world price as measured in the GSO data on sectoral border prices, the tariff inclusive home currency form.

The empirical models presented below were developed based on Equations (5) - (8). They allow for violations of the LOP in both the short and long run, hence imperfect price transmission. LOP may be statistically tested for using parameter estimates from the models presented below. They are also used to measure the specific impact of inflation and to test for inflation neutrality.

Two groups of price transmission models -- level regressions and first-difference regressions -- are applied in order to measure the extent to which the world price is transmitted into Vietnam's domestic market. In the first group of models the dependent variable in logarithmic form is directly regressed on independent variables, and in the second group of models all the variables are taken as first differences. Specifically, the first group of models includes the following two regressions:

$$lnP_{kt}^{d} = \mu_k + \theta_k lnP_{kt}^{w} + \varepsilon_{kt} \quad (9)$$

$$lnP_{kt}^{d} = \mu_k + \theta_k lnP_{kt}^{w} + \alpha_k lnCPI_{Ht} + \varepsilon_{kt} \quad (10)$$

where P_{kt}^{d} denotes domestic price in sector *k* in time *t*, P_{kt}^{w} denotes the tariff-inclusive world price in home currency in sector *k* in time *t*, CPI_{Ht} denotes the consumer price index in Vietnam in time *t*, and ε_{kt} is the error term.

The first model is a level regression including only world price as the independent variable, which is a direct logarithmic regression model based on Equation (8). The estimation results for this simplest specification can be used to test the LOP and to compare with the results for other specifications to assess how much new information is offered by additional independent variables. The second model adds domestic CPI to the first model to test if domestic inflation has had a more important impact on sectoral domestic price variation than through the transmission of nominal, currency adjusted world prices, and if the pass-through of inflation is neutral across sectors. Since P_{kt}^{w} and P_{kt}^{d} are both nominal prices, in principle the effects of neutral inflation are already incorporated into Equation (8), and in the direct relationship between P_{kt}^{w} and P_{kt}^{d} [see equation (7)]. The variables in both models are expressed in logarithmic terms. Hence, the

magnitudes of the coefficients on the independent variables can be interpreted as elasticities. θ_k in this specification is the price transmission elasticity. In the following discussions, the first model, expressed in Equation (9), is referred to as the "level model without inflation", and the second model, expressed in Equation (10), is referred to as the "level model with inflation".

Time series data often suffer from serial correlation of the disturbance terms across periods. Also, since the adjustment of prices tends to be sluggish, the LOP may be violated in the short term despite the convergence to the LOP in the long run. If we only estimate the level regression models, we may falsely reject the LOP by overlooking dynamic processes in price transmission. These series may be non-stationary as well, introducing further statistical problems. Facing these potential problems, first-difference models, particularly with an error correction term in two specifications below, are employed (Baffes and Gardner, 2003). The first-difference model is able to correct for serial correlation, and the error correction model circumvents the problem of sluggish price adjustment by including a short-run adjustment term, which allows for removal of deviations from long-run equilibrium in the short term. It also corrects for first order stationarity.

Since we have very short time series available, testing for cointegration and stationarity and estimating their order are not practical. While we cannot be certain without these tests whether moving to a first difference model is necessary, both level models and first difference models are reported. Results are qualitatively similar and behave as expected when moving between these two specifications. Parameter estimates for price transmission are somewhat lower in first difference models, but inflation effects are stable.

The mathematical expressions of the second group of empirical models are displayed as follows:

$$\left(P_{kt}^{d} - P_{kt-1}^{d}\right) = \mu_k + \theta_k(P_{kt}^{w} - P_{kt-1}^{w}) + \varepsilon_{kt} \tag{11}$$

$$\left(P_{kt}^{d} - P_{kt-1}^{d}\right) = \mu_k + \gamma_k\left(P_{kt-1}^{w} - P_{kt-1}^{d}\right) + \theta_k(P_{kt}^{w} - P_{kt-1}^{w}) + \varepsilon_{kt} \tag{12}$$

$$\left(P_{kt}^{d} - P_{kt-1}^{d}\right) = \mu_k + \gamma_k\left(P_{kt-1}^{w} - P_{kt-1}^{d}\right) + \theta_k(P_{kt}^{w} - P_{kt-1}^{w}) + \alpha_k(CPI_{Ht} - CPI_{Ht-1}) + \varepsilon_{kt} \tag{13}$$

The same notation is used as in Equations (9) and (10). The third model, expressed in Equation (11), is a strict first difference form of the level regression without inflation. The fourth model, shown in Equation (12), is the standard error correction model (Baffes and Gardner, 2003). The cointegration term of the error correction model is $(P^{w}_{kt-1} - P^{d}_{kt-1})$. The long-run cointegrating coefficient, which is based on the coefficient on $-P^{d}_{kt-1}$, is assumed to equal 1. This corresponds with the notion that the long-run correlation between world and domestic prices is one-to-one, i.e., long-run convergence to the LOP is assumed. However, if both $\gamma_k$and θ_k are equal to zero, then the term of long-run convergence to the LOP vanishes, and the violation of the LOP can be inferred. The fifth model, shown in Equation (13), is the error correction model with an inflation term. If both $\gamma_k$and θ_k are equal to zero in this model specification, then it turns into a regression of the relationship between the domestic price and inflation – in first differences. In future discussions, the third model is referred to as "first difference model without inflation", the fourth model is referred to as "error correction model (ECM)", and the fifth model is referred to as "ECM with inflation". All of the first-difference models are not in logarithmic form, because the difference terms may be negative for certain years and certain sectors, hence logarithms would be undefined. Since all indices in the base year are equal to 100, the coefficients on the difference terms are still elasticities if the base-year levels are used in computing elasticities. Thus, we may interpret θ_k as approximately a price transmission elasticity in these specifications.

As mentioned in the previous section, θ_k gauges how much of a given change in world price is transmitted into the domestic price in the current time period in sector *k*, and γ_k is the speed-of-adjustment parameter for sector *k*, measuring how much of the deviation from the long-run equilibrium can be eliminated in each time period in sector *k*. Moreover, in models (10) and (13) we add inflation rate as a dependent variable to account for the possible effect of non-neutral inflation on domestic prices in different sectors. Coefficient α_k indicates the degree to which inflation passes through in sector *k*.

In addition to normal significance tests against zero for all the parameters, a couple of other hypotheses can be tested from the above models. The first hypothesis is regarding the validity of LOP in each sector. If LOP holds, then it suggests co-movement between domestic

and world prices and perfect market integration in the sector[3]. The null hypothesis of this test is formally written as:

$$H_0: \theta_k = 1$$

Also, the question regarding whether or not inflation is neutrally transmitted into different sectors can be addressed. Neutral inflation pass-through implies that individual sectors experience the same level of inflationary pressure as the entire economy. When the transmission coefficient θ_k is insignificant, the world price is not capturing inflationary pressure. Neutral inflation pass-through implies that the inflation coefficient α_k is equal to unity. When the transmission coefficient θ_k is significantly different from zero but not significantly different from one, neutral inflation pass-through implies that the inflation coefficient α_k is equal to zero. Formally, the second hypothesis to be tested is:

$$H_0: \theta_k = 0, \alpha_k = 1$$

or,

$$H_0: \theta_k = 1, \alpha_k = 0$$

If $\theta_k = 0, \alpha_k \neq 1$, then the inflation pass-through is non-neutral. However, if $\theta_k \neq 1$, then the neutrality of inflation pass-through is dependent on the magnitude of α_k. Only if $\theta_k + \alpha_k = 1$, then inflation pass-through is neutral.

It is worth noting that three other model specifications were estimated to experiment with further possible deviations from the LOP. If LOP fails, other specifications based on other theories may apply. A simple example is that domestic prices are simply rising with domestic inflation as captured in Equations (10) and (13), and when $\theta_k = 0$. The three alternative independent variables corresponding to three possible explanations for deviations from the LOP are the real exchange rate e_t^r, a wage index w_t as a substitute for the CPI as a measure of inflation, and the tariff $(1 + T_k)$, all of which are components already included in the world price P_{kt}^w as used in the models above[4]. If the LOP holds for the sectors, then the coefficients on these

[3] Variable tariffs that might limit price transmission have been taken into account by using the tariff inclusive home currency world price.

[4] P_{kt}^w is measured as the tariff-inclusive world price in home currency.

alternative variables should be insignificant and the parameter on the world price (θ_k) should equal to one. If those components have dominant effects on the domestic prices and the LOP does not hold in the sector, then the coefficients on e_t^r, w_t, or $(1 + T_{kt})$ would be significant. In the case of neutral wage driven inflation, when the world price does not influence the domestic price, the coefficient on the wage index approaches one. Also, all of the three alternative specifications are estimated using the ECM specification as the starting point, which is theoretically the most sound model. We tried those additional variables in other model specifications, and the results are qualitatively similar to the results from the ECM with the additional variables. For the purpose of presentation, only the alternative models built on the ECM are presented here.

Specifically, the first experimental model adds the real effective exchange rate (REER - e_t^r) to the ECM with inflation [Equation (13)] to evaluate the tradability (or lack thereof) of various products in different sectors. Theoretically, REER is defined as the relative price between tradables and non-tradables. If the product of a given sector is largely non traded, then its domestic price tends to move positively with the price index of non-tradable goods, which is the denominator of the REER. Hence, the parameter on REER should be significant and negative. If the product in a given sector is extensively traded, then the parameter on this variable is likely to be insignificant since it offers little new information in addition to the world price, which is viewed as a price measure of traded commodities.

In the second experimental model specification CPI is substituted by a wage index (w_t) as an alternative proxy for the inflation rate in the ECM with inflation and the real exchange rate. If inflation in Vietnam is cost-push (or wage driven) inflation, then the wage index should outperform CPI as an explanatory variable since the wage index captures the change in labor cost, which is an important component of total cost, over time. If the inflation is a demand-pull inflation, then the difference in explanatory power between CPI and wage index should not be pronounced[5].

[5] In Vietnam, the wage index is highly correlated with the CPI with correlation coefficient of 0.87. This could be due to cost-push inflation or demand-pull inflation with wages quickly following. Both mechanisms are likely to matter in Vietnam.

The third experimental model incorporates the tariff $(1 + T_{kt})$ into the ECM with inflation to evaluate the potential importance of trade policy on domestic prices. The world price is already tariff-inclusive. This exercise aims to examine if trade policy plays any role beyond what is already captured in the world price (especially since we will find $\theta_k = 0$ in many cases). If tariff has any additional effect on domestic prices in the importing sectors, then the coefficient on the tariff is expected to be significant and positive.

In general, the models proposed above follow Level I testing methods due to lack of data on transfer costs, which is necessary for Level II analysis. Also, reversal of trade flows is not common based on the sectoral trade flow data taken from GSO (2009). In fact, two-way trade is observed for most disaggregated sectors, even at the 87-sector aggregation level. Hence Level III analysis is not appropriate for this study. Within the framework of Level I analysis, we maximize data usage efficiency by building simple, constrained models that allow us to test the extent of market integration and neutrality of inflation pass-through. All the testing results are sector specific, enabling us to explore various degrees of sectoral variations. Also, the first-difference model permits the combination of short-run dynamics and long-run equilibrium, which offers additional information about the dynamics of price adjustment. In all cases very parsimonious models are employed due to limited degrees of freedom.

5. Data

We assembled annual time series data on prices and inflation over the years 1999-2008 for Vietnam. All the data are indices with 1999 as the base year. The price series were obtained from the GSO (2009). Domestic prices (P_{kt}^{d}) are as received by producers. World prices (P_{kt}^{w}) are export prices for the exporting sectors, and are import prices for the importing sectors. The world prices as obtained from the GSO are tariff inclusive and measured in local currency (Dong), which corresponds to the term P_{kt}^{w} in Equations (8) through (13). In addition, the distinction between exporting sectors and importing sectors are not free from ambiguity due to the presence of two-way trade flows in most sectors. The classification of sectors in terms of trade status follows Boys (2008), and her classification is based on the dominant direction of the trade flows during the period from 2000 to 2005 (see Table 1). The inflation level (CPI_{Ht}) is measured by

consumer price indices taken from the IMF (2010). For the alternative model specifications, the REER (e_t^r) data are taken from the IMF (2010), the wage indices (w_t) are from the Economist (2010), and. The tariff variable is only used for import sectors.

Furthermore, in this study we experimented with three levels of sectoral aggregations to estimate these models. The specific criteria for the aggregations can be found in Boys (2008). The aggregation schemes and concordance of the sectors at various aggregation levels are presented in Table 1. The first level of aggregation includes 87 sectors, which is an extraction of traded-sectors from the 112-sector aggregation typically used by GSO. The twenty-five service sectors are not included in this analysis because those sectors are viewed as non-traded sectors and hence no sectoral data on export and import prices are reported by GSO. Thus, there is no world price data for service sectors. Regressions were run for each of the 87 tradable sectors. At the second level of aggregation the 87 sectors are mapped into 24 sectors as in Abbott, Boys, Huong, and Tarp (2008). The 24-sector aggregated export and import prices are averages weighted by trade values. Similarly, aggregated domestic prices were calculated as averages weighted by gross output levels of the 87 sectors. For the alternative model specification, the tariff variable was aggregated by trade values. Both trade and output data were also available from GSO (2009). The models were estimated for each of the 24 sectors. The third level of aggregation consists of five sectors, namely, the agriculture export sector, agriculture import sector, manufacturing export sector, manufacturing import sector, and energy and resources import sector. This level of aggregation was developed mainly for presentation purposes and for examining whether estimation efficiency could be achieved by pooling sectors into this high level of aggregation. Panel regressions were run for each of these five sectors. Those panel regressions replicate the pooling strategy employed in Abbott, Wu and Tarp (2010) that resulted in very low price transmission elasticity estimates.

6. Results

Regression results are reported in Tables 3-7 for the "level" regression models (Equations 9 and 10) and Tables 8-12 for the "ECM with inflation" regression models (Equation 13). Tables group estimates from the six highly aggregated sectoral categories together in single

tables. Appendix A reports regression results for the first difference model with inflation and the ECM (without inflation) in a similar manner. Only key parameters on price transmission and inflation pass-through are reported. Table 2 highlights the effects of aggregation, and the differences between models with and without inflation. Table 13 reports hypothesis tests on market integration using the ECM model. Table 14 explores neutrality of inflation pass-through. Table 15 reports speed of adjustment parameters from the ECM model in order to test for long run convergence to LOP.

Subsequent discussion of results explores the key findings from this research. We first discuss the perils of aggregation, and the apparent aggregation bias when a pooling strategy is employed. Then the extent of price transmission found in Vietnam is revealed and the extent of market integration or segmentation is explored. Speed of adjustment and long run convergence to LOP is then considered. The power of inflation, over world prices, to explain domestic prices is subsequently examined. Finally, specifications that examine the alternatives explanations for deviations from LOP are briefly discussed.

6.1. Perils of Aggregation and Pooling

Regression results show that large variation exists across sectors regardless of model specification. For example, the elasticity of price transmission in each sector, which is measured by parameter θ_k, ranges widely. The means and standard deviations of the estimated price transmission elasticities are shown in Table 2. The standard deviation is around twice of the mean level, suggesting high variance across sectors.

Pooling tried to achieve estimation efficiency given the short samples, but the aggregated regressions can hardly be sufficient to represent the transmission of world prices of all the sectors within an aggregated group. Moreover, the parameter estimates of the 5-sector panel regressions appear to be biased downward. Aggregated data lead to error in measuring the world and domestic prices of the given sector, and result in underestimation of the parameter, which is referred to as attenuation or aggregation bias. The level regression without inflation, in which world price is the only dependent variable, can serve as an illustration of aggregation bias. The first two columns of Table 3 to Table 7 report the estimation results for this regression model. In

the agricultural export sector (see Table 3), the aggregated agricultural export sector has a transmission coefficient smaller than any of the parameter estimates of the sectors at the 24-sector aggregation level (i.e. 0.34 compared with 0.92, 0.43, 0.52, 1.74, and 1.35). Similar results are found for the other aggregated categories in Tables 4-7.

The parameter estimates at the 24-sector level tend to be dominated by the largest sector, and thus are unable to be a representative estimate of the entire aggregated sector, as well. Coefficient estimates for aggregate categories are clearly not averages of the sub-category component coefficient estimates. In the agricultural export sector (see Table 3), the transmission elasticity at 24-sector aggregation level is 0.52, which is equal to the elasticity estimate of raw rubber, but less than one half of the parameter estimate for tea (1.23), and less than one fourth of the parameter estimate for processed tea (2.35). If using regression results at the 24-sector aggregation level for the agricultural export sector, then the transmission of world tea and processed tea prices would be greatly underestimated, as would be the aggregate effect on the overall sector. Once again, other broad categories exhibit similar results, showing substantial aggregation bias.

The differences in parameter estimates between various aggregation levels signal the danger of only running aggregated regressions and then using a uniform price transmission elasticity for all the sectors in the aggregated group, which may lead to biased results in further policy assessment. The disaggregated 87 sectoral regressions are strongly preferred. For example, if we wish to calculate effects of tariff changes on domestic prices, much smaller impacts are found using aggregate sector transmission elasticties than when disaggregated tariffs and transmission elasticties are used.

6.2. Price Transmission

Despite the quantitative differences in the parameter estimates on transmission elasticities, the regression results at all aggregation levels univocally show imperfect price transmission and insensitive domestic price responses to world price overall. This is demonstrated by price transmission elasticities (θ_k) significantly different from unity in most cases. Nevertheless, the price transmission elasticities significantly deviate from zero for most sectors, as well. The fact

that the transmission elasticities are different from both zero and one suggests a certain level of imperfect, partial transmission from world prices to domestic prices. However, transmission is not frictionless.

The wide sectoral variation in terms of the estimated transmission elasticities begs two questions: which sectors are integrated into the world market, and which sectors are segmented from the world market. These questions are answered based on the estimation results for the ECM with inflation (Equation 13) (see Tables 8 to 12). If the estimated price transmission elasticity θ_k is significantly different from zero but not from one, then it can be categorized as an integrated sector. On the contrary, if the estimated price transmission elasticity θ_k is significantly different from one but not from zero, then the sector is labeled as segmented sector.[6] The results of these classifications are summarized in Table 13. In the exporting agricultural sectors, only the sectors of processed tea and other crops are closely linked with the world market, whereas importing agricultural sectors producing sugar, pig, and processed vegetables, animal oils and fats are well integrated with the world market. Among manufacturing export sectors, sectors producing carpet and processed wood and other wood products can be classified as integrated sectors. Seven out of 40 manufacturing import sectors are integrated with the world market, and four of the integrated sectors are chemical products. In total, only 14 of 87 sectors pass the test on market integration. Only 15%, 18%, 40%, and 18% of the agricultural export sectors, agricultural import sectors, manufacturing export sectors, and manufacturing import sectors, respectively, are categorized as integrated sectors.

At the other extreme, 30 sectors are segmented from the world market, as the transmission elasticities are nearly zero. Among those sectors, fish-farming and fishery are intermediate goods for processed seafood and leather goods, respectively, which are less connected with the world market relative to their corresponding final goods. Electricity and gas are products under heavy protection, and their domestic prices are often decoupled from the world prices. In addition, some products such as animal feeds, alcohol, beer and liquor, and cigarettes and other tobacco products are less traded with the rest of the world, and hence have low level of price transmission. In total, 38%, 33%, 20%, 35%, and 100% of the agricultural

[6] We also consider sectors to be segmented if coefficients are significantly less than zero, hence incorrectly signed. Moreover, if a coefficient is significantly less than zero, it must also be significantly less than one.

export sectors, agricultural import sectors, manufacturing export sectors, manufacturing import sectors, and energy import sectors, respectively, are classified as segmented sectors.

All the sectors except for manufacturing export sectors exhibit a higher percentage of sectors classified as segmented, rather than integrated. Manufacturing export sectors have the largest proportion of sectors classified as integrated. In the panel regressions, this is the only highly aggregated sector that showed significant world price transmission. For the purpose of simplification in future studies, those integrated sectors may have one assumed to be their transmission elasticities, whereas those segmented sectors may have zero as their transmission elasticities. Other sectors exhibit partial price transmission, and point estimates of transmission elasticities might be used.

6.3. Speed-of-Adjustment

The ECM and the ECM with inflation models include the speed-of-adjustment coefficient (γ_k). This coefficient measures how much of the deviation from the long-run equilibrium can be eliminated in each time period in sector k. It also may be used to test whether price transmission is complete in the long run, even if it is not in the short run. The larger the coefficient is, the faster the adjustment toward long-run equilibrium is. If these parameters are significant, then the LOP holds in the long run, as domestic prices coverage to world prices. The estimates of this parameter are presented in the first columns in Tables 8 to 12, and in the third columns in Tables A1 to A5. The speed-of-adjustment parameter is not significantly different from zero for most sectors (67 in the ECM with inflation model), which indicates no significant adjustment made in the short run in order to converge to the LOP. Alternatively speaking, for most sectors the speed of adjustment to the LOP is very low. Based on the estimation results for the ECM with inflation, among those few sectors with speed-of-adjustment parameters significantly different from zero, half of them, namely, sectors of processed tea, other crops, refined sugar, pig, carpets, processed wood and wood products, basic organic chemicals, basic inorganic chemicals, other chemical products, and automobiles, are classified as integrated sectors indicated by the transmission elasticities (see Table 15), implying that well integrated sectors tend to eliminate the wedge between world and domestic prices relatively quickly. Domestic prices closely follow world

prices, and the convergence to the LOP can be fulfilled during a relatively short time period in those few sectors. Most sectors appear disconnected from world prices, based on this measure as well as price transmission elasticities.

6.4. Inflation

The next question worth exploring is to what extent inflation affected domestic prices in different sectors, or how different sectors weathered inflation. Table 2 also shows the importance of inflation as an explanatory variable for domestic prices, and that price transmission estimates diminish greatly once inflation is explicitly included. In the case of the levels regression models, the average of price transmission elasticity estimates falls from one to zero when inflation is taken into account.

The level regression with inflation is one of the two models including the inflation rate as a separate independent variable, the estimation of which illustrates the importance of including inflation explicitly. The third to the sixth columns of Tables 3 to 7 report estimation results with the inflation variable added. Large variation in the magnitude of the inflation parameter α_k indicates that the effect of inflation varies across sectors. For example, in the agricultural sectors (see Tables 3 and 4), the inflation coefficient α_k is only 0.35 for the processed agricultural import sector, whereas it reaches 1.58 for the processed rice sector. Nonetheless, one similarity across sectors is that inflation has positive impact on domestic prices in almost all the sectors at the 87-sector aggregation level. Only four sectors have a negative (but insignificant) inflation parameter. The positive sign on the inflation parameter indicates that domestic sectoral prices increase as inflation goes up. Also, except for seven sectors at the 87-sector aggregation level that have insignificant inflation parameters, the inflation parameter for all the other sectors are significantly different from zero at the 10% or 1% level. By contrast, 50 sectors at the 87-sector aggregation level have insignificant transmission coefficient in the level regression model with inflation. This result suggests that inflation is much better at explaining the variation in domestic prices than are world prices. Moreover, when adding inflation rate to the model, the price transmission elasticities (θ_k) fall dramatically. This suggests that the inflation component in the world prices (P_{kt}^{w}) picks up much of the information that is useful in expaining the variation of

domestic prices. The results are consistent with the notion that the domestic market is not fully connected with the world market for many sectors, and sectoral prices are still dominantly affected by the domestic inflation rate rather than prices on the world market.

Also, in order to test for the neutrality of inflation pass-through, the coefficient on the inflation can be compared against one when the transmission coefficient is not significantly different from zero, and can be compared against zero when the transmission coefficient is significant. If the inflation coefficient is significantly different from zero but not significantly different from one when the transmission coefficient is insignificant (i.e., $\theta_k = 0,\ \alpha_k = 1$), or if the inflation coefficient is not significantly different from zero when the transmission coefficient is significant (i.e.,$\theta_k = 1,\ \alpha_k = 0$), then the pass-through of inflation in that sector is viewed as neutral. However, if the inflation coefficient is significantly different from zero and also significantly different from one when the transmission coefficient is insignificant (i.e.,$\theta_k = 0,\ \alpha_k \neq 1$), then the pass-through of inflation in that sector is regarded as non-neutral. The classification of neutral versus non-neutral inflation pass-through is summarized in Table 14. The reference model for this classification is the ECM with inflation model (see Tables 8 to 12 for complete regression results). Many results are consistent with neutral inflation pass-through. At the 87-sector aggregation level, 30 sectors show neutral inflation pass-through, while 12 sectors show non-neutral inflation pass-through according to this criterion. Some sectors such as cow and paper pulp sectors exhibit higher levels of price surge and tend to be hit more severely by inflation, while others such as the animal feed sector, and food sector producing cakes, jams, candy, coca, and chocolate products show a lower level of price increase than the overall inflation level in the economy, which weathered inflation well. For the other 45 sectors the neutrality of inflation pass-through is ambiguous. The reason is that the transmission coefficient θ_k is significantly different from both zero and one, and the significance tests on individual parameters, θ_k and α_k, are not sufficient. The test on $H_0: \theta_k + \alpha_k = 1$ is needed in this case to establish inflation neutrality.

6.5. Alternative Model Specifications

Tables A6 to A10 report alternative error correction models, including the REER, a wage index, or the tariff index as additional independent variables. The purpose of constructing these alternative model specifications is to examine if other theories may apply if the LOP fails. In principle, we have constrained estimation according to Equation (5) or Equation (7), and these alternatives allow for relaxation of those constraints as well as testing of whether the constraints are valid. For example, Equations 9-13 restrict the exchange rate, world prices, and tariffs all to have the same effect on domestic prices, while alternative specifications examine whether these effects may somehow differ. Our earlier tests on inflation as an explicit variable relax the constraint that real world prices and inflation have the same quantitative effect on domestic prices, that follows from LOP.

The first columns of Tables A6 to A10 report the regression results with the REER (e_t^r) as an independent variable. As discussed in the Model Section, if the product of a given sector is largely non-traded, then its domestic price tends to move positively with the price index of non-tradable goods, which is the denominator of the REER. Hence the parameter on the REER should be significant and negative. The regression results show that the REER coefficient is not significantly different from zero for most sectors, indicating insufficiency to attribute the deviation from the LOP to the existence of large proportion of home goods for most sectors. Among those few sectors that have a significant REER coefficient, 64% of the sectors, namely, sectors of tea, other livestock, glass and glass products, ceramic and by-product, home appliances and its spare parts, plastic, and other transport means, have a negative REER coefficient. Those sectors may have a large proportion of non-tradables in their total production.

The second columns of Tables A6 to A10 report the regression results for the ECM with wage index (w_t) as a substitute for CPI as an inflation indicator. The wage index does not explain the variation in domestic prices as well as the CPI. More coefficients on the wage index are insignificant than the coefficients on the CPI in the same specification of the model. This is contrary to the prediction under cost-push inflation, for which a wage index should serve as a better proxy for the inflation than the CPI. The regression results are in favor of demand-pull inflation. However, more rigorous tests may be needed to examine the root causes of inflation.

The third columns of Tables A7, A9, and A10 report the regression results for the ECM with a tariff index ($1 + T_{kt}$) as an independent variable for the import sectors. This variable is

insignificant for most sectors, which suggests that the world price has captured the role of trade policy (or at least tariffs as a component of that policy) for most sectors. If the transmission elasticity θ_k is insignificant, tariffs still do not matter. Trade policy, at least working through tariff changes, does not have dominant impact on domestic prices. This result also suggests that trade policy may not be the major cause of the disconnection between world and domestic markets. There is not evidence of widespread stabilizing regimes either, consistent with this finding.

7. Conclusions

During the past two decades Vietnam has witnessed increasing engagement with the world market, which was achieved through entry into international trading agreements, altered border policies, institutional reforms, and relaxation of controls on foreign investment. These endeavors have been repaid with rapid GDP growth, expanding trade, and increasing foreign investment. Unfortunately, high rates of inflation have also accompanied the development process at times. Annual CPI growth rate moved from an average of 366% over 1986 - 1988 to 38% in 1992. Inflation was less than 10% from 1993 to 2007 except for 1995, indicating inflation was under control during this period. However, in 2008 CPI growth rate reached 23%. It receded to 7% in 2009, but is expected to surpass 10% again this year. Recent inflation experience may be related to opening Vietnam to the world economy, and may be driven in part by events abroad such as global recession and the collapse of world trade, with recovery abroad bringing inflation again.

This study explored how these two macroeconomic phenomena, namely, increasing world market integration and inflation, impact domestic prices. Specifically, the degree to which the world price changes are transmitted into the domestic market, and the level of sectoral inflation pass-through are investigated. The estimation models we employed are grouped into two categories: the first group of models features direct regressions of a dependent variable on the independent variables, whereas the second group of models is in first-difference form to correct for possible serial correlation between disturbance terms in the time series and to

incorporate dynamic processes in price transmission. Also, the model specifications include the most basic form which only contains world price as the independent variable, the level regression models with world price and inflation as independent variables, and the error correction models with and without the inflation term. With data taken from GSO (2009) and IMF (2010), models were estimated at three levels of sectoral aggregations.

We found that large sectoral variation exists in world price transmission. Panel regressions at a 5-sector aggregation level without sufficient sectoral details are unable to adequately represent the transmission mechanism of individual sectors in each group. Twenty-four sector aggregation results are dominated by the largest sector, and thus the estimates are not able to represent individual sectors within the aggregated group. Thus, sectoral regressions at 87-sector aggregation level are needed to avoid generating biased transmission estimates that will be fed into models for trade policy analysis.

The sectoral regression results show that the price transmission elasticities (θ_k) are both significantly different from zero and significantly different from one for most sectors, which indicates that the price transmission is present but imperfect for most sectors. Fourteen out of 87 sectors are defined as integrated sectors, which have transmission coefficients significantly different from zero but not significantly different from one based on the estimation results for the error correction model with inflation. By comparison, 30 out of 87 sectors are defined as segmented sectors, which have transmission coefficients significantly different from one but not significantly different from zero or having a negative transmission coefficient. All the sectors except for manufacturing export sectors exhibit a higher percentage of sectors classified as segmented than integrated. Manufacturing export sectors have the largest proportion of sectors classified as integrated.

Half of the 14 integrated sectors have a significant speed-of-adjustment parameter estimate (γ_k), which is exceptional among all the sectors. For 67 sectors the speed of adjustment term is insignificant. This finding suggests that well integrated sectors tend to eliminate the differentials between domestic and world prices relatively quickly. However, the speed-of-adjustment parameter is not statistically significant for most sectors, contradicting the proposition of long-run convergence to the LOP in those cases. Thus, price transmission is low in the long run as well as in the short run.

The effect of inflation is also measured in the models. The results show clearly non-neutral inflation pass-through for 12 sectors, which is indicated by the deviation of the inflation parameter (α_k) from unity when the transmission coefficient (θ_k) is insignificant. Some sectors have large coefficients on the inflation term, suggesting a higher level of price increase than the overall economy when there is inflation. Yet some sectors have small inflation coefficients. These prices are only mildly affected by the inflation. Despite the variation across sectors, two regularities can be found regarding the inflation variable. First, inflation has positive impact on domestic sectoral prices for most sectors. The higher the inflation is, the higher the domestic price is. Second, inflation is better at explaining the variation of domestic prices than the world price, which is again consistent with the fact that the connection between domestic and world prices remains limited for most sectors. The price transmission elasticities are much lower when inflation is included, indicating that inflation picks up much of the information that is useful in explaining the variation of domestic prices.

Alternative specifications allowed us to conclude that the CPI better explains prices than wages, suggesting that demand-pull inflation is more important than cost-push inflation. The divergence from the LOP seems not due to home goods effects, due to the insignificance of the real exchange rate as an explainer of prices. Stabilization policy at the border also seems not to be a significant factor, as tariff effects were measured and not found to significantly explain the degree of price transmission.

In summary, sectoral specific regressions are useful in distinguishing differences across sectors, which are pronounced in Vietnam. Aggregated sectors are unable to represent individual sectors due to large sectoral variations and aggregation bias, leading to the adoption of sectoral regression models at 87-sector aggregation level. The estimation results show imperfect price transmission in most sectors. This may be an indicator of limited integration between domestic and world markets. Long-run convergence to the LOP does not hold for most sectors, as well. We found that inflation is better at explaining domestic price variation compared to world prices, which may also be a result of imperfect market integration. Moreover, only twelve sectors show clearly non-neutral inflation pass-through, but the effect of inflation varies widely across sectors, with some sectors bearing strong pressure while others are only being slightly affected. Demand-pull inflation seems the best explanation of domestic prices.

These results suggest that traditional trade policy analysis for Vietnam often exaggerates the effects of world market prices, exchange rates and tariffs on the domestic economy. Tariff impacts are muted by the low price transmission elasticties found here. To do trade policy analysis correctly, a disaggregated approach is required, and careful attention must be paid to how inflation impacts the economy. Estimation of relevant parameters is needed, given the substantial sectoral variations observed. These results reinforce the notion that institutional reform, market access opening overseas, and incentives to foreign investment are more important than Vietnam's tariff concessions. More research is called for on the relationship between an open Vietnamese economy and the mechanisms of inflation determination.

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Tables

Figures

Table 1. Aggregation Schemes and Concordance of Economic Sectors

6 Sector Aggregation[1]	Trade Status[2]	35 Sector Aggregation[3]	112 Sector Aggregation[3]
Agriculture Export	E	1. Rice (paddy, processed)	001. Paddy (all kinds) 035. Rice, processed
	E	2. Fish, Seafood and seafood byproducts	014. Fishery 015. Fish-Farming 034. Processed seafood and by-products
	E	3. Major Export Oriented Crops	002. Raw rubber 003. Coffee beans 005. Tea 032. Tea, processed
	E	4. Processed Agricultural Exports	026. Processed and preserved fruits and vegetables 036. Other fruit manufactures 052. Processed rubber and by-products
	E	5. Other Crops	006. Other crops
Agriculture Home/Import	M	6. Sugar and Animal Feed	004. Sugarcane 030. Sugar, refined 082. Animal feeds
	M	7. Livestock and livestock products	007. Pig (all kinds) 008. Cow (all kinds) 009. Poultry 010. Other livestock and poultry 022. Processes, preserved meat and by-products
	M	8. Forestry	013. Forestry
Manufacturing Export	E	10. Ready made clothes; fiber, carpets	077. Ready-made clothes, sheets (all kinds) 078. Carpets 079. Weaving and embroidery of textile-based goods (except carpets)
	E	11. Leather goods	081. Leather goods
	E	12. Processed wood and wood products	044. Processed wood and wood products

Table 1 continued

6 Sector Aggregation[1]	Trade Status[2]	35 Sector Aggregation[3]	112 Sector Aggregation[3]
Manufacturing Home/Import	M	13. Other (potential) manufactured export goods	037. Glass and glass products 038. Ceramics and by-products 064. Bicycles and spare parts 065. General-purpose machinery 066. Other general-purpose machinery 070. Electrical machinery 071. Other electrical machinery and equipment
	M	14. Building materials (bricks, tiles, cement etc.)	039. Bricks, tiles 040. Cement 041. Concrete, mortar and other cement products 042. Other building materials
	M	15. Pulp & Paper Products, Paper By-Products	043. Paper pulp and paper products and by-products
	M	16. Chemical Industries	045. Basic organic chemicals 046. Basic inorganic chemicals 047. Chemical fertilizer 048. Fertilizer 049. Pesticides 053. Soap, detergents 054. Perfumes and other toilet preparations 057. Paint 058. Ink, varnish and other painting materials 059. Other chemical products
	M	17. Home Appliances and Spare Parts	062. Home appliances and its spare parts
	M	18. Processed Plastic & Plastic Products	055. Plastic (including semi-plastic products) 056. Other plastic products

Table 1 continued

6 Sector Aggregation[1]	Trade status[2]	35 Sector Aggregation[3]	112 Sector Aggregation[3]
Manufacturing Home/Import	M	19. Ferrous and Non-ferrous metals & metal products	073. Non-ferrous metals and products 074. Ferrous metals and products (except machinery equipment)
	M	20. Weaving of cloth (all kinds), fiber (thread)	075. Weaving of cloths (all kinds) 076. Fibber, thread (all kinds)
	M	21. Special purposes machinery and equipment	060. Health instrument and apparatus 061. Precise and optics equipment, meter (all kinds) 072. Machinery used for broadcasting, television and information activities
	M	22. Automobiles; Motor vehicles, motorbikes, parts	063. Motor vehicles, motor bikes and spare parts 067. Other special-purpose machinery 068. Automobiles
	M	23. Other manufactured goods	050. Veterinary medicine 051. Health medicine 069. Other transport means 083. Products of printing activities 084. Products of publishing house 085. Other physical goods
Energy & Resources	M	24. Electricity, gas; (Refined) Gasoline and lubricants	086. Gasoline, lubricants (already refined) 087. Electricity, gas
	E	25. Mining and quarrying; Water	016. Coal 017. Metallic ore 018. Store 019. Sand, gravel 020. Other non-metallic minerals 088. Water
	E	26. Crude oil, natural gas (except exploration)	021. Crude-oil, natural gas (except exploration)

Table 1 continued

6 Sector Aggregation[1]	Trade Status[2]	35 Sector Aggregation[3]	112 Sector Aggregation[3]
Energy & Resources	H	27. Air, road, railway and water transportation	095. Transportation 096. Railway transport services 097. Water transport services 098. Air transport services 113. Domestic marketing margins
Services	E	28. Communication	099. Communication services
	M	29. Financial Services	101. Banking, credit, treasury 103. Insurance
	H	30. Real Estate, Real estate business and consultancy	105. Real estate 106. Real estate business and consultancy services
	H	31. Trade (Wholesale, Retail)	091. Trade 114. Export marketing margins
	H	32. Construction (Civil, Other)	089. Civil construction 090. Other construction
	M	33. Social Services and Defense	107. State management, defense and compulsory social services 108. Education and training 109. Health care, social relief 110. Culture and sport 111. Association
	H	34. Agricultural Services (Irrigation, Other)	011. Irrigation service 012. Other agricultural services
	E	35. Other Services	092. Repair of small transport means, motorbikes and personal household appliances 093. Hotels 094. Restaurants 100. Tourism 102. Lottery 104. Science and technology 112. Other services

Table 1 continued

6 Sector Aggregation[1]	Trade Status[2]	35 Sector Aggregation[3]	112 Sector Aggregation[3]
Services	E	35. Other Services	092. Repair of small transport means, motorbikes and personal household appliances 093. Hotels 094. Restaurants 100. Tourism 102. Lottery 104. Science and technology 112. Other services

Notes:

[1] The six-sector aggregation was developed mainly for the purpose of clarity in presentation and for the attempt to pool sectoral data.

[2] Sectors are classified as being dominated by exports (E), imports (I), or home (H) goods. Most sectors exhibit a combination of exports and imports.

[3] The 112-sector aggregation includes 87 tradable sectors and 25 non-tradable service sectors. The 35-sector aggregation includes 24 tradable sectors. The 6-sector aggregation includes 5 tradable sectors. Services are treated as non-tradable for all aggregation schemes.

Table 2. Means and Standard Deviations of the Estimated Elasticities (θ_k) of Price Transmission

	Various aggregation levels		87-sector aggregation	
	Mean	**Std. dev.**	**Mean**	**Std. dev.**
Level model without inflation	0.90	1.72	0.87	1.87
Level model with inflation	0.00	0.93	0.00	0.98
First difference model without inflation	0.97	1.71	1.03	1.66
Error Correction Model (ECM)	0.63	1.74	0.65	1.78
ECM with inflation	0.34	1.04	0.40	1.13

[1] The means and standard deviations reported here are simple, un-weighted measures from the sectoral estimates for each model. The first two columns use all aggregations, whereas the third and fourth columns use only the detailed, disaggregated 87sector estimates. In the level model, where variables are in logarithmic form, θ_k is an elasticity, and in the first difference models, since variables are indices, θ_k is an elasticity in the base year (1999).

Table 3. Estimation Results for Level Models for the Agricultural Export Sectors

Sector Code	Sector Name	Level Model without Inflation		Level Model with Inflation			
		Transmission Coefficient (θ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
1	***Agr Export***	0.34**††	0.04	0.08*††	0.03	0.89**†	0.05
1	**Rice**	0.92**	0.09	0.17†	0.37	0.99*	0.48
1	Paddy (all kinds)	0.97**	0.10	0.82	0.50	0.19	0.65
35	Rice, processed	0.88**	0.11	-0.32††	0.34	1.58**	0.44
2	**Fish**	0.43**††	0.06	0.02††	0.08	0.89**	0.16
14	Fishery	0.67**†	0.15	0.21*††	0.05	0.80**†	0.06
15	Fish - Farming	0.24**††	0.04	0.08*††	0.02	0.71**†	0.09
34	Processed seafood and by products	1.11**	0.11	1.31	2.17	-0.16	1.70
3	**Export**	0.52**††	0.11	-0.17†	0.38	0.95	0.51
2	Raw rubber	0.52*†	0.18	0.12††	0.08	0.99**	0.13
3	Coffee beans	0.32*††	0.15	-0.92*††	0.39	1.77**	0.54
5	Tea	1.23**	0.22	0.50	0.42	0.52*	0.26
32	Tea, processed	2.35**†	0.41	0.42†	0.26	0.64**††	0.08
4	**Process Export**	1.74**††	0.12	0.34	0.49	0.77*	0.26
26	Processed and preserved fruits and vegetables	0.04	0.67	-0.06††	0.09	0.82**	0.04
36	Other food manufactures	0.86**	0.23	-0.66*††	0.34	0.88**	0.19
52	Processed rubber and by products	1.97**††	0.28	-0.23†	0.43	1.79**†	0.33
5	**Other Crops**						
6	Other crops	1.35**†	0.17	0.45†	0.24	0.78**	0.19

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 4. Estimation Results for Level Models for the Agricultural Import Sectors

Sector Code	Sector Name	Level Model without Inflation		Level Model with Inflation			
		Transmission Coefficient (θ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
2	***Agr Import***	-0.02††	0.02	-0.07††	0.01	0.84**††	0.03
6	**Sugar**	0.62**†	0.13	-0.11††	0.15	0.64**†	0.12
4	Sugarcane	2.85**††	0.40	1.39	2.19	0.34	0.50
30	Sugar, refined	2.60**††	0.44	0.95	2.41	0.39	0.55
82	Animal feeds	0.44**††	0.11	-0.16††	0.11	0.59**††	0.09
7	**Meat**	1.98**†	0.33	0.68	0.47	0.75**	0.24
7	Pig (All kinds)	2.25**††	0.33	0.86	1.11	0.78	0.60
8	Cow (All kinds)	2.99*†	1.05	0.25	0.70	1.21**	0.22
9	Poultry	0.92**	0.26	0.19††	0.21	0.95**	0.21
10	Other Livestock	-0.18†	0.43	-0.08††	0.16	0.72**†	0.10
22	Processed, preserved meat and by-products	1.92**†	0.43	0.72**	0.17	0.53**††	0.05
9	**Process M**	0.14**††	0.04	-0.04*††	0.02	0.35**††	0.09
23	Processed vegetable, and animals oils and fats	0.29	0.47	0.39**††	0.11	0.85**†	0.07
24	Milk, butter and other dairy products	1.31**†	0.14	-0.28††	0.22	1.17**	0.16
25	Cakes, jams, candy, coca, chocolate products	0.76**†	0.11	-0.01††	0.09	0.59**††	0.06
27	Alcohol, beer and liquors	-0.30**††	0.05	-0.12*††	0.04	0.94**	0.20
28	Beer and liquors	5.24**†	1.56	0.45	0.68	0.70**††	0.07
29	Non-alcohol water and soft drinks	-0.03	1.92	0.32	0.51	0.72**††	0.07
31	Coffee, processed	2.21**†	0.56	-2.65*††	0.82	1.26**	0.20
33	Cigarettes and other tobacco products	0.03*††	0.02	-0.04**††	0.01	0.67**††	0.06
80	Products of leather tanneries	0.12*††	0.04	-0.05††	0.05	0.72**	0.20

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 5. Estimation Results for Level Models for the Manufacturing Export Sectors

		Level Model without Inflation		Level Model with Inflation			
Sector Code	**Sector Name**	**Transmission Coefficient (θ_k)**	**Std. Err.**	**Transmission Coefficient (θ_k)**	**Std. Err.**	**Inflation Coefficient (α_k)**	**Std. Err.**
3	***Manf Export***	0.58*†	0.25	-0.37*††	0.20	0.86	0.09
10	**Clothes**	1.58	0.87	-0.48††	0.27	0.80**†	0.07
77	Ready -made clothes, sheets (all kinds)	1.64*	0.88	-0.45††	0.29	0.81**†	0.07
78	Carpets	0.38	1.26	-1.50**††	0.39	1.07**	0.11
79	Weaving and embroidery of textile - based goods (except carpets)	0.69	0.60	-0.61*††	0.31	0.55**††	0.08
11	**Leather**						
81	Leather goods	0.49†	0.27	-0.85*††	0.28	0.76**	0.14
12	**Wood**						
44	Processed wood and wood products	2.25**††	0.23	-0.39†	0.70	1.53**	0.40

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 6. Estimation Results for Level Models for the Manufacturing Import Sectors

Sector Code	Sector Name	Level Model without Inflation		Level Model with Inflation			
		Transmission Coefficient (θ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
4	***Manf Import***	0.14**††	0.03	0.05**††	0.02	0.67**††	0.02
13	**Oth pE Mf**	0.22††	0.12	-0.39*††	0.16	0.47**††	0.11
37	Glass and glass products	0.70	0.44	0.61	0.46	-0.06††	0.07
38	Ceramics and by products	0.31††	0.19	-0.18	1.02	0.30	0.61
64	Bicycles and spare parts	-0.29*††	0.14	-0.24††	0.19	0.01††	0.04
65	General -purpose machinery	0.55**†	0.14	0.11††	0.16	0.75**	0.22
66	Other general -purpose machinery	0.73**	0.14	-0.12††	0.29	0.58**†	0.18
70	Electrical machinery	0.95**	0.24	-0.35††	0.35	0.68**	0.17
71	Other electrical machinery and equipment	0.29†	0.22	-1.30**††	0.36	0.92**	0.20
14	**Building**	1.56**††	0.10	0.42*†	0.22	0.81**	0.15
39	Bricks, tiles	1.30**	0.34	0.28††	0.16	0.90**	0.11
40	Cement	1.17**†	0.08	0.63*	0.27	0.54*	0.26
41	Concrete, mortar and other cement products	2.47**††	0.38	-0.04	0.61	1.05**	0.24
42	Other building materials	3.89**††	0.56	0.07	1.08	1.05**	0.28
15	**Paper**						
43	Paper pulp and paper products and by products	6.49**††	0.92	3.66*	1.87	0.61	0.36
16	**Chemical**	1.51**†	0.22	-0.09††	0.15	1.08**	0.09
45	Basic organic chemicals	2.69**†	0.77	-0.11†	0.33	1.10**	0.10
46	Basic inorganic chemicals	1.68	1.17	-0.40*††	0.20	0.95**	0.05
47	Chemical fertilizer	0.73**†	0.09	0.11††	0.07	1.23**	0.13
48	Fertilizer	1.43**	0.34	-0.23†	0.43	1.17**	0.27
49	Pesticides	0.33	0.44	-0.91**††	0.14	0.68**††	0.05
53	Soap, detergents	-1.46**††	0.40	-0.20*††	0.18	0.41**††	0.04
54	Perfumes and other toilet preparation	3.86	5.27	-4.00**††	0.91	0.92**	0.05
57	Paint	-0.26**††	0.04	-0.13**††	0.02	0.58**††	0.08
58	Inl, varnish and other painting materials	-0.93**††	0.22	-0.43*††	0.22	0.49*†	0.16
59	Other chemical products	6.82**††	0.96	0.05	1.16	1.02**	0.17

Table 6 continued

		Level Model without Inflation		Level Model with Inflation			
Sector Code	**Sector Name**	**Transmission Coefficient (θ_k)**	**Std. Err.**	**Transmission Coefficient (θ_k)**	**Std. Err.**	**Inflation Coefficient (α_k)**	**Std. Err.**
17	**Appliance**						
62	Home appliances and its spare parts	0.80	1.14	-0.61††	0.43	0.49**††	0.06
18	**Plastic**	0.93**	0.16	0.02†	0.46	0.93*	0.45
55	Plastic (including semi-plastic products)	1.40**	0.35	-0.03††	0.29	1.13**	0.19
56	Other plastic products	0.73**††	0.07	0.95*	0.33	-0.29†	0.44
19	**Metals**	0.19**††	0.05	-0.10**††	0.03	1.06**	0.09
73	Non-ferrous metals and products (except machinery equipment)	0.30**††	0.08	-0.18*††	0.06	1.14**	0.13
74	Ferrous metals and products (except machinery equipment)	0.14**††	0.03	-0.02††	0.04	0.78**	0.16
20	**Weaving**	0.88**	0.17	-0.13††	0.22	0.74**	0.15
75	Weaving of cloths (all kinds)	-1.14*††	0.49	-0.38*††	0.12	0.62**††	0.05
76	Fibers, thread (all kinds)	0.18**††	0.05	-0.06††	0.07	0.67**†	0.16
21	**Machine**	-0.22**††	0.04	-0.18*††	0.08	0.07††	0.10
60	Health instrument and apparatus	-4.37*†	1.72	-0.77	1.30	0.50**††	0.12
61	Precise and optics equipment, meter (all kinds)	-0.37	0.84	0.08	0.64	0.19*††	0.07
72	Machinery used for broadcasting, television and information activities	-0.14**††	0.03	-0.15*††	0.06	-0.03††	0.12
22	**Auto**	0.85*††	0.24	-0.48††	0.36	0.35**††	0.09
63	Motor vehicles, motor bikes and spare parts	-0.06*††	0.03	0.00††	0.05	0.11††	0.08
67	Other special -purpose machinery	0.41*††	0.13	-0.25†	0.36	0.41*†	0.22
68	Automobiles	3.41**†	0.78	1.60*	0.73	0.37**††	0.11
23	**Oth M Mf**	0.72**††	0.08	0.07††	0.05	0.79**††	0.05
51	Health medicine	0.40**††	0.04	0.16*††	0.06	0.75**	0.17
69	Other transport mean	-1.82**††	0.53	-0.28††	0.23	0.53**††	0.06
83	Products of printing activities	-4.11†	2.61	3.46*	1.57	1.16**	0.18
84	Products of publishing house	-4.96**††	0.68	-1.16†	0.73	0.56**††	0.10

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 7. Estimation Results for Level Models for the Energy Import Sectors

Sector Code	Sector Name	Level Model without Inflation		Level Model with Inflation			
		Transmission Coefficient (θ_k)	**Std. Err.**	**Transmission Coefficient (θ_k)**	**Std. Err.**	**Inflation Coefficient (α_k)**	**Std. Err.**
5	***Energy Import***	0.19*††	0.10	-0.51**††	0.11	3.08**††	0.42
24	**Electricity**	0.32**††	0.06	-0.05††	0.05	0.97**	0.13
86	Gasoline, lubricants (already refined)	0.56**†	0.13	-0.41††	0.26	2.91**†	0.73
87	Electricity, gas	0.16**††	0.03	-0.05††	0.04	1.04**	0.18

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 8. Estimation Results for the Error Correction Model (ECM) with Inflation for the Agricultural Export Sectors

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
1	***Agr Export***	-0.02	0.01	0.09**††	0.04	1.12**	0.08
1	**Rice**	-0.14	0.42	-0.06†	0.38	2.06*	0.61
1	Paddy (all kinds)	0.07	0.67	0.42	0.56	1.60	0.92
35	Rice, processed	0.29	0.39	-0.22†	0.50	1.97*	0.73
2	**Fish**	-0.04	0.06	-0.05††	0.10	1.19**	0.31
14	Fishery	-0.20	0.21	-0.08††	0.30	1.14**	0.27
15	Fish - Farming	-0.01	0.01	0.00††	0.04	0.93*	0.30
34	Processed seafood and by products	1.01	0.59	1.09	2.40	0.32	1.57
3	**Export**	0.25	0.21	0.07†	0.25	0.58	0.41
2	Raw rubber	0.38	0.48	0.56	0.71	0.89	0.81
3	Coffee beans	0.22	0.20	-0.10†	0.35	0.36	0.55
5	Tea	0.85*	0.37	0.81	0.50	0.84*	0.37
32	Tea, processed	0.64**	0.18	0.84*	0.36	1.11**	0.06
4	**Process E**	0.18	0.31	0.83	0.56	0.63*	0.22
26	Processed and preserved fruits and vegetables	0.14	0.12	-0.24††	0.25	1.15**	0.15
36	Other food manufactures	0.07	0.40	0.33	0.88	0.64	0.35
52	Processed rubber and by products	0.18	0.31	1.01	0.74	1.10*	0.50
5	**Other Crop**						
6	Other crops	0.73*	0.34	0.78*	0.34	1.11**	0.21

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 9. Estimation Results for the Error Correction Model (ECM) with Inflation for the Agricultural Import Sectors

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
2	***Agr Import***	0.00	0.00	0.00††	0.01	1.10**	0.08
6	**Sugar**	0.21	0.19	0.06††	0.27	0.39†	0.21
4	Sugarcane	0.77*	0.32	0.72	1.44	0.92**	0.23
30	Sugar, refined	1.43**	0.34	3.50*	1.66	0.75*	0.27
82	Animal feeds	0.01	0.16	-0.11††	0.26	0.50*†	0.24
7	**Meat**	1.41*	0.45	0.86*	0.41	2.33**††	0.25
7	Pig (All kinds)	2.41*	0.84	1.56*	0.70	3.14**††	0.40
8	Cow (All kinds)	1.24*	0.19	1.25	0.70	3.66**††	0.30
9	Poultry	0.01	0.34	0.08†	0.25	1.63**†	0.29
10	Other Livestock	0.56	0.46	0.72	1.11	1.33**	0.29
22	Processed, preserved meat and by-products)	0.40	0.36	0.54	0.48	0.91**	0.23
9	**Process M**	0.00	0.01	0.00††	0.01	0.70**†	0.14
23	Processed vegetable, and animals oils and fats	0.52	0.34	1.64*	0.67	0.66*	0.32
24	Milk, butter and other dairy products	0.49	0.64	-0.16†	0.54	1.29**	0.25
25	Cakes, jams, candy, coca, chocolate products	0.11	0.16	0.65	0.64	0.35**††	0.12
27	Alcohol, beer and liquors	0.07	0.07	-0.84†	0.48	2.59**††	0.25
28	Beer and liquors	0.12	0.31	0.53	1.38	0.75*	0.29
29	Non-alcohol water and soft drinks	0.95*	0.28	2.05	1.13	1.58**†	0.19
31	Coffee, processed	0.10	0.26	0.68	1.96	0.76**	0.15
33	Cigarettes and other tobacco products	0.00	0.00	0.00††	0.00	0.26††	0.15
80	Products of leather tanneries	0.01	0.03	0.03††	0.05	0.41	0.45

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 10. Estimation Results for the Error Correction Model (ECM) with Inflation for the Manufacturing Export Sectors

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
3	***Manf Export***	0.00	0.05	0.09††	0.29	0.63**††	0.13
10	**Clothes**	0.42	0.33	1.21	1.02	0.59*	0.25
77	Ready -made clothes, sheets (all kinds)	0.46	0.34	1.36	1.09	0.61*	0.27
78	Carpets	0.48*	0.16	1.83*	0.76	0.75*	0.23
79	Weaving and embroidery of textile -based goods (except carpets)	0.72*	0.31	1.08	0.73	0.46*†	0.22
11	**Leather**						
81	Leather goods	-0.04	0.40	-0.99†	0.87	0.79*	0.36
12	**Wood**						
44	Processed wood and wood products	0.45*	0.21	1.08*	0.52	1.43**	0.26

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 11. Estimation Results for Error Correction Model (ECM) with Inflation for the Manufacturing Import Sectors

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
4	***Manf Import***	0.01	0.01	-0.01††	0.03	0.68**††	0.04
13	**Oth pE Mf**	-0.12	0.12	-0.47†	0.44	0.57*†	0.18
37	Glass and glass products	0.63	0.38	0.31	0.77	0.04††	0.17
38	Ceramics and by products	0.44	0.39	0.14	1.09	-0.07†	0.48
64	Bicycles and spare parts	0.14	0.13	-0.13††	0.21	0.11††	0.06
65	General -purpose machinery	0.14	0.12	0.61*	0.30	0.46	0.31
66	Other general -purpose machinery	0.07	0.33	-0.55†	0.54	0.52*†	0.23
70	Electrical machinery	-0.51	0.41	-1.04†	0.60	0.87**	0.18
71	Other electrical machinery and equipment	0.11	0.26	-1.10†	0.81	0.60	0.31
14	**Building**	0.53	0.26	0.87*	0.29	1.05**	0.12
39	Bricks, tiles	0.47*	0.20	0.31	0.51	1.33**	0.23
40	Cement	0.28	0.39	0.74**	0.20	0.68**†	0.12
41	Concrete, mortar and other cement products	0.41	0.41	0.74	1.02	1.35**	0.30
42	Other building materials	0.17	0.45	0.35	2.31	1.26**	0.34
15	**Paper**						
43	Paper pulp and paper products and by products	1.26*	0.42	2.49	2.10	3.82**†	0.79
16	**Chemical**	0.34	0.28	0.33†	0.29	1.13**	0.15
45	Basic organic chemicals	0.81**	0.10	0.78**	0.17	2.22**††	0.11
46	Basic inorganic chemicals	0.50*	0.19	1.78*	0.84	1.05**	0.17
47	Chemical fertilizer	-0.08	0.07	0.00††	0.07	1.73**††	0.15
48	Fertilizer	0.91*	0.33	0.48	0.70	1.85**	0.45
49	Pesticides	0.08	0.18	-1.17*††	0.53	0.70*	0.21
53	Soap, detergents	-0.08	0.20	0.77	1.19	0.04††	0.21
54	Perfumes and other toilet preparation	0.02	0.20	-3.65†	2.07	0.71*	0.26
57	Paint	0.29	0.22	1.11	1.05	0.91**	0.19
58	Inl, varnish and other painting materials	0.43**	0.08	0.64	0.48	1.35**	0.18
59	Other chemical products	0.39**	0.02	0.83**	0.15	1.60**††	0.03

Table 11 continued

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
17	**Appliance**						
62	Home appliances and its spare parts	-0.36	0.49	-1.22	2.11	0.00††	0.23
18	**Plastic**	0.51	0.33	0.73	0.48	0.26†	0.35
55	Plastic (including semi-plastic products)	0.62	0.31	0.42	0.51	1.41*	0.45
56	Other plastic products	0.06	0.34	0.72*	0.29	-0.14†	0.41
19	**Metals**	0.01	0.03	-0.04††	0.04	0.84*	0.27
73	Non-ferrous metals and products (except machinery equipment)	0.04	0.05	-0.02††	0.09	0.78*	0.27
74	Ferrous metals and products (except machinery equipment)	0.01	0.02	-0.04††	0.03	0.56	0.33
20	**Weaving**	0.36*	0.17	0.09††	0.19	0.42**††	0.10
75	Weaving of cloths (all kinds)	0.42	0.37	1.65	1.83	0.68*	0.24
76	Fibers, thread (all kinds)	0.04	0.05	0.00††	0.11	0.13†	0.40
21	**Machine**	-0.04	0.12	-0.64†	0.43	0.10†	0.29
60	Health instrument and apparatus	0.17	0.36	-0.77	3.02	0.45	0.39
61	Precise and optics equipment, meter (all kinds)	1.12*	0.34	1.61	1.44	0.39*†	0.18
72	Machinery used for broadcasting, television and information activities	-0.03	0.10	-0.62††	0.34	0.08†	0.30
22	**Auto**	0.66*	0.20	-0.29††	0.28	0.22*††	0.08
63	Motor vehicles, motor bikes and spare parts	-0.06	0.10	-0.46†	0.51	0.10††	0.19
67	Other special -purpose machinery	0.07	0.17	-1.31*††	0.50	0.35*†	0.17
68	Automobiles	0.85*	0.40	3.63*	1.66	0.45	0.30
23	**Oth M Mf**	-0.11*	0.05	0.10††	0.06	0.93**	0.07
51	Health medicine	-0.02	0.02	-0.08*††	0.04	1.19**	0.17
69	Other transport mean	-0.14	0.17	-0.76	1.26	0.18†	0.25
83	Products of printing activities	0.20	0.51	2.70	1.47	1.99**†	0.41
84	Products of publishing house	0.09	0.15	-2.00†	1.12	0.64*	0.20

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 12. Estimation Results for Error Correction Model (ECM) with Inflation for the Energy Import Sectors

Sector Code	Sector Name	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.	Inflation Coefficient (α_k)	Std. Err.
5	***Energy Import***	-0.04	0.03	-0.10††	0.07	2.10**†	0.51
24	**Electricity**	0.04	0.04	-0.01††	0.04	0.52*†	0.24
86	Gasoline, lubricants (already refined)	0.17	0.17	-0.21††	0.29	2.33*	1.06
87	Electricity, gas	0.01	0.02	0.01††	0.04	0.60	0.43

Notes: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table 13. Integrated and Segmented Sectors+

Integrated Sectors			Segmented Sectors		
Sector Code	**Sector Name**	**Transmission Coefficient (θ_k)**	**Sector Code**	**Sector Name**	**Transmission Coefficient (θ_k)**
32	Tea, processed	0.84	35	Rice, processed	-0.22
6	Other crops	0.78	14	Fishery	-0.08
30	Sugar, refined	3.50	15	Fish - Farming	0.00
7	Pig (All kinds)	1.56	3	Coffee beans	-0.10
23	Processed vegetable, and animals oils and fats	1.64	26	Processed and preserved fruits and vegetables	-0.24
78	Carpets	1.83	82	Animal feeds	-0.11
44	Processed wood and wood products	1.08	9	Poultry	0.08
65	General -purpose machinery	0.61	24	Milk, butter and other dairy products	-0.16
40	Cement	0.74	27	Alcohol, beer and liquors	-0.84
45	Basic organic chemicals	0.78	33	Cigarettes and other tobacco products	0.00
46	Basic inorganic chemicals	1.78	80	Products of leather tanneries	0.03
59	Other chemical products	0.83	81	Leather goods	-0.99
56	Other plastic products	0.72	64	Bicycles and spare parts	-0.13
68	Automobiles	3.63	66	Other general-purpose machinery	-0.55
			70	Electrical machinery	-1.04
			71	Other electrical machinery and equipment	-1.10

Table 13 continued

Integrated Sectors			Segmented Sectors		
Sector Code	**Sector Name**	**Transmission Coefficient (θ_k)**	**Sector Code**	**Sector Name**	**Transmission Coefficient (θ_k)**
			47	Chemical fertilizer	0.00
			49	Pesticides	-1.17
			54	Perfumes and other toilet preparation	-3.65
			62	Home appliances and its spare parts	-1.22
			73	Non-ferrous metals and products (except machinery equipment)	-0.02
			74	Ferrous metals and products (except machinery equipment)	-0.04
			76	Fibers, thread (all kinds)	0.00
			72	Machinery used for broadcasting, television and information activities	-0.62
			63	Motor vehicles, motor bikes and spare parts	-0.46
			67	Other special -purpose machinery	-1.31
			69	Other transport mean	-0.76
			84	Products of publishing house	-2.00
			86	Gasoline, lubricants (already refined)	-0.21
			87	Electricity, gas	0.01

Notes: Integrated sectors have a price transmission elasticity θ_k significantly different from zero but not from one. Segmented sectors have a price transmission elasticity θ_k significantly different from one but not from zero. Incorrectly signed (negative) coefficients are not considered significant for purposes of establishing segmented sectors.

Table 14. Neutrality of Inflation Pass-Through

Sectors with Neutral Inflation Pass-Through			Sectors with Non-Neutral Inflation Pass-Through		
Sector Code	**Sector Name**	**Inflation Coefficient (α_k)**	**Sector Code**	**Sector Name**	**Inflation Coefficient (α_k)**
35	Rice, processed	1.97	25	Cakes, jams, candy, coca, chocolate products	0.35
14	Fishery	1.14	61	Precise and optics equipment, meter (all kinds)	0.39
15	Fish - Farming	0.93	79	Weaving and embroidery of textile - based goods (except carpets)	0.46
5	Tea	0.84	82	Animal feeds	0.50
26	Processed and preserved fruits and vegetables	1.15	66	Other general -purpose machinery	0.52
52	Processed rubber and by products	1.10	29	Non-alcohol water and soft drinks	1.58
4	Sugarcane	0.92	9	Poultry	1.63
10	Other Livestock	1.33	47	Chemical fertilizer	1.73
22	Processed, preserved meat and by-products)	0.91	83	Products of printing activities	1.99
24	Milk, butter and other dairy products	1.29	27	Alcohol, beer and liquors	2.59
28	Beer and liquors	0.75	8	Cow (All kinds)	3.66
31	Coffee, processed	0.76	43	Paper pulp and paper products and by products	3.82
77	Ready -made clothes, sheets (all kinds)	0.61			
81	Leather goods	0.79			
70	Electrical machinery	0.87			
39	Bricks, tiles	1.33			
41	Concrete, mortar and other cement products	1.35			
42	Other building materials	1.26			
48	Fertilizer	1.85			

Table 14 continued

Sectors with Neutral Inflation Pass-Through			Sectors with Non-Neutral Inflation Pass-Through		
Sector Code	**Sector Name**	**Inflation Coefficient (α_k)**	**Sector Code**	**Sector Name**	**Inflation Coefficient (α_k)**
54	Perfumes and other toilet preparation	0.71			
57	Paint	0.91			
58	Inl, varnish and other painting materials	1.35			
55	Plastic (including semi-plastic products)	1.41			
73	Non-ferrous metals and products (except machinery equipment)	0.78			
75	Weaving of cloths (all kinds)	0.68			
84	Products of publishing house	0.64			
86	Gasoline, lubricants (already refined)	2.33			
65	General-purpose machinery	0.46			
56	Other plastic products	-0.14			
68	Automobiles	0.45			

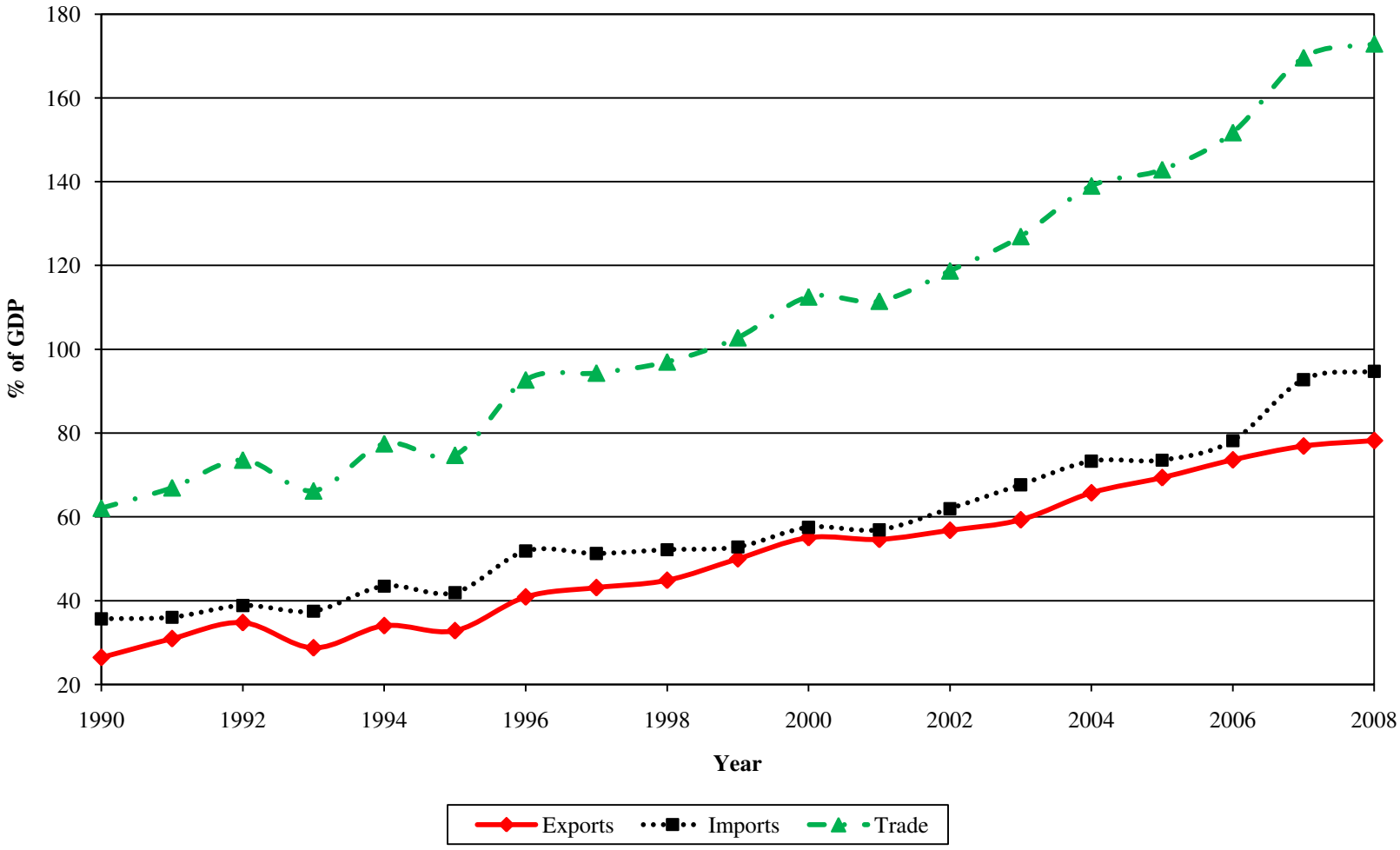
Notes: The inflation pass-through in a given sector is defined as neutral if the inflation coefficient in that sector is significantly different from zero but not significantly from one when the transmission coefficient is insignificant (i.e., $\theta_k = 0,\ \alpha_k = 1$), or if the inflation coefficient is not significantly different from zero when the transmission coefficient is significant (i.e., $\theta_k = 1,\ \alpha_k = 0$). The inflation pass-through in a given sector is defined as non-neutral if the inflation coefficient in that sector is significantly different from zero and also significantly different from one when the transmission coefficient is insignificant (i.e., $\theta_k = 0,\ \alpha_k \neq 1$),

Table 15. Sectors with a Significant Speed-of-Adjustment Parameter

Sector Code	Sector Name	Adjustment Coefficient (γ_k)
5	Tea	0.85*
32	Tea, processed	0.64**
6	Other crops	0.73*
4	Sugarcane	0.77*
30	Sugar, refined	1.43**
7	Pig (All kinds)	2.41*
8	Cow (All kinds)	1.24**
29	Non-alcohol water and soft drinks	0.95*
78	Carpets	0.48*
79	Weaving and embroidery of textile -based goods (except carpets)	0.72*
44	Processed wood and wood products	0.45*
39	Bricks, tiles	0.47*
43	Paper pulp and paper products and by products	1.26*
45	Basic organic chemicals	0.81**
46	Basic inorganic chemicals	0.50*
48	Fertilizer	0.91*
58	Inl, varnish and other painting materials	0.43**
59	Other chemical products	0.39**
61	Precise and optics equipment, meter (all kinds)	1.12*
68	Automobiles	0.85*

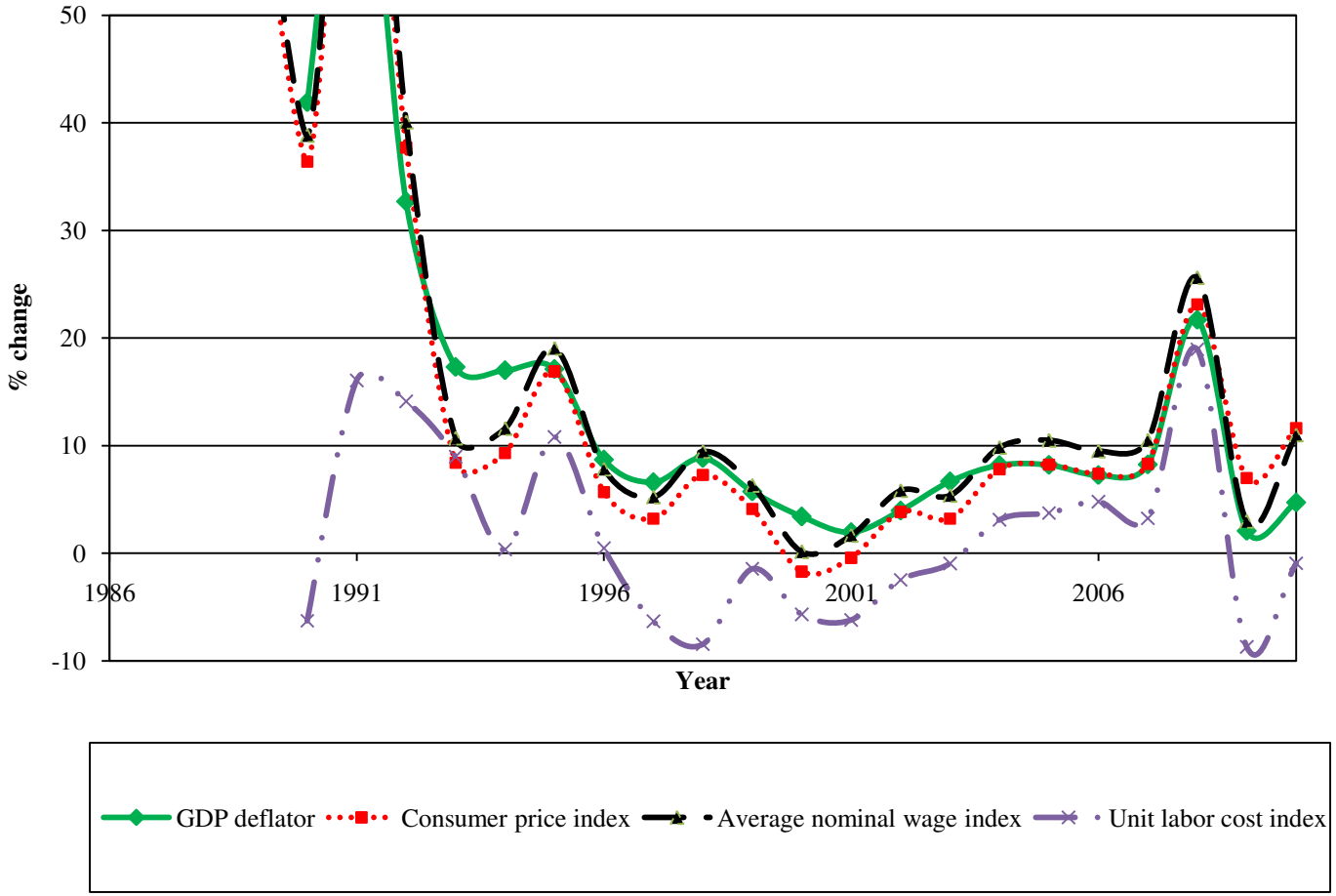
Notes: * and **denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.

Figure 1. Trade and GDP, 1990-2008



Source: International Monetary Fund, *International Financial Statistics* (2010)

Figure 2. Inflation, 1986-2010



Note: Indicators in 2010 are estimated by the *Economist Intelligence Unit*.

Source: Economist, *Economist Intelligence Unit Country Data* (2010)

Appendix A: Estimation Results for the First Difference Model, Error Correction Model (ECM), and Error Correction Models (ECM) with Alternative Independent Variables

Table A1. Estimation Results for the First Difference Model and the Error Correction Model (ECM) for the Agricultural Export Sectors

Sector Code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
1	***Agr Export***	0.17**††	0.05	-0.02	0.02	0.21**††	0.06
1	**Rice**	1.24**	0.24	0.71	0.56	1.12**	0.25
1	Paddy (all kinds)	1.47**	0.26	0.69	0.66	1.24**	0.34
35	Rice, processed	1.05*	0.29	0.85	0.46	1.02**	0.25
2	**Fish**	0.15††	0.20	0.15*	0.07	0.07††	0.17
14	Fishery	0.09†	0.30	0.48	0.27	0.73	0.45
15	Fish - Farming	0.03††	0.07	0.03	0.01	0.02††	0.06
34	Processed seafood and by products	1.84**†	0.36	0.98	0.52	1.57**	0.34
3	**Export**	0.53*	0.26	0.44*	0.18	0.27†	0.22
2	Raw rubber	0.66*	0.19	0.69	0.39	1.24**	0.36
3	Coffee beans	0.30†	0.35	0.31*	0.14	-0.02†	0.31
5	Tea	1.34*	0.49	0.60	0.46	1.56**	0.49
32	Tea, processed	2.08*	0.90	-0.70	1.16	0.60	2.64
4	**Process E**	1.64*	0.38	-0.08	0.44	1.53*	0.74
26	Processed and preserved fruits and vegetables	0.54	0.47	-0.36	0.33	-0.15	0.79
36	Other food manufactures	1.32*	0.70	0.68*	0.27	1.71*	0.55
52	Processed rubber and by products	1.45*	0.46	-0.26	0.30	0.74	0.94
5	**Other Crop**						
6	Other crops	1.23*	0.42	0.73	0.79	1.72*	0.68

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table A2. Estimation Results for the First Difference Model and the Error Correction Model (ECM) for the Agricultural Import Sectors

Sector code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
2	***Agr Import***	0.00††	0.01	0.00	0.00	0.00††	0.01
6	**Sugar**	0.14†	0.41	0.44*	0.18	0.16†	0.31
4	Sugarcane	2.71	1.79	0.47	0.58	3.77	2.25
30	Sugar, refined	2.46	2.12	1.14*	0.48	5.71*†	2.13
82	Animal feeds	-0.02†	0.35	0.24	0.15	0.02†	0.31
7	**Meat**	1.74	0.95	-0.56	1.61	1.29	1.63
7	Pig (All kinds)	2.58	1.38	-0.33	2.57	2.35	2.31
8	Cow (All kinds)	4.57*†	1.74	0.30	0.91	5.40	3.09
9	Poultry	0.75	0.45	-0.45	0.82	0.55	0.60
10	Other Livestock	0.66	0.57	-0.28	0.90	-0.05	2.32
22	Processed, preserved meat and by-products)	1.67*	0.45	-0.44	0.53	1.07	0.85
9	**Process M**	0.02††	0.03	0.03*	0.01	0.03††	0.02
23	Processed vegetable, and animals oils and fats	1.34*	0.31	0.21	0.38	1.75*	0.82
24	Milk, butter and other dairy products	1.97*	0.83	-1.72	1.12	2.07*	0.76
25	Cakes, jams, candy, coca, chocolate products	2.03*	1.00	0.40*	0.20	1.15	0.95
27	Alcohol, beer and liquors	0.93	0.81	-0.22	0.29	-0.48	2.04
28	Beer and liquors	0.80	1.85	-0.57*	0.23	-1.24	1.66
29	Non-alcohol water and soft drinks	3.02	1.99	-0.83	0.62	-1.14	3.64
31	Coffee, processed	4.38*	2.98	0.01	0.60	4.44	4.16
33	Cigarettes and other tobacco products	0.00††	0.00	0.00*	0.00	0.00††	0.00
80	Products of leather tanneries	0.03††	0.05	0.03	0.02	0.04††	0.05

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table A3. Estimation Results for the First Difference Model and the Error Correction Model (ECM) for the Manufacturing Export Sectors

Sector Code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
3	***Manf Export***	0.76*	0.33	-0.07	0.06	0.68	0.33
10	**Clothes**	0.86	0.57	-0.06	0.34	0.65	1.33
77	Ready -made clothes, sheets (all kinds)	0.91	0.61	-0.02	0.35	0.85	1.38
78	Carpets	0.72	0.64	0.20	0.22	1.65	1.22
79	Weaving and embroidery of textile -based goods (except carpets)	0.52	0.65	0.58	0.37	1.52	0.87
11	**Leather**						
81	Leather goods	-1.10	1.12	0.64*	0.33	-0.30	1.03
12	**Wood**						
44	Processed wood and wood products	1.91*	0.80	-0.16	0.42	1.58	1.24

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table A4. Estimation Results for the First Difference Model and the Error Correction Model (ECM) for the Manufacturing Import Sectors

Sector Code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
4	***Manf Import***	0.06*††	0.03	0.01	0.01	0.05††	0.03
13	**Oth pE Mf**	-0.14	0.71	0.18	0.13	-0.12	0.68
37	Glass and glass products	0.53	0.69	0.63	0.35	0.41	0.60
38	Ceramics and by products	0.59	0.77	0.41	0.28	0.05	0.81
64	Bicycles and spare parts	-0.19††	0.21	0.04	0.14	-0.17††	0.24
65	General -purpose machinery	0.36	0.42	0.26*	0.10	0.53	0.32
66	Other general -purpose machinery	-0.05	0.69	0.53	0.34	0.00	0.63
70	Electrical machinery	-0.04	0.98	0.60	0.75	0.41	1.15
71	Other electrical machinery and equipment	-0.23	1.03	0.42	0.25	-0.65	0.94
14	**Building**	1.05	0.74	-1.24	0.66	-0.37	0.99
39	Bricks, tiles	-1.06†	1.03	-0.03	0.46	-1.07	1.12
40	Cement	1.01*	0.42	0.30	0.93	0.99*	0.46
41	Concrete, mortar and other cement products	1.60	1.25	-0.68	0.66	-0.09	2.04
42	Other building materials	3.18	1.75	-0.76	0.67	-1.00	4.06
15	**Paper**						
43	Paper pulp and paper products and by products	9.70*†	3.41	-0.47	0.48	8.15*	3.78
16	**Chemical**	0.95	0.61	-1.43*	0.53	-0.91†	0.82
45	Basic organic chemicals	1.51	1.23	-0.79	0.55	0.22	1.45
46	Basic inorganic chemicals	1.89*	0.89	-0.05	0.45	1.68	2.26
47	Chemical fertilizer	0.25†	0.36	0.42	0.23	0.22†	0.31
48	Fertilizer	1.56	0.87	0.41	0.58	2.04	1.13
49	Pesticides	-0.33†	0.54	0.14	0.28	-0.14	0.70
53	Soap, detergents	1.43*	0.71	-0.10	0.13	0.81	1.07
54	Perfumes and other toilet preparation	-2.59	3.05	-0.38*	0.19	-5.19†	2.87
57	Paint	0.36†	0.27	-0.12	0.43	-0.24	2.18
58	Inl, varnish and other painting materials	0.75	1.06	0.08	0.20	1.17	1.56
59	Other chemical products	4.13	3.61	-0.52	0.30	-0.02	3.96

Table A4 continued

Sector Code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
17	**Appliance**						
62	Home appliances and its spare parts	0.44	0.70	-0.36	0.38	-1.22	1.89
18	**Plastic**	0.60	0.38	0.51	0.31	0.91*	0.39
55	Plastic (including semi-plastic products)	0.67	0.62	0.05	0.39	0.72	0.80
56	Other plastic products	0.66*	0.20	-0.01	0.24	0.66*	0.23
19	**Metals**	0.03†	0.08	0.07*	0.03	0.02††	0.06
73	Non-ferrous metals and products (except machinery equipment)	0.07†	0.17	0.15*	0.06	0.03††	0.12
74	Ferrous metals and products (except machinery equipment)	-0.03†	0.04	0.03*	0.01	-0.03††	0.03
20	**Weaving**	0.25†	0.30	0.35	0.31	0.39	0.32
75	Weaving of cloths (all kinds)	0.78	0.57	-0.32	0.39	-1.04	2.35
76	Fibers, thread (all kinds)	0.01††	0.12	0.06	0.03	0.00††	0.10
21	**Machine**	-0.48††	0.33	-0.06	0.08	-0.63††	0.40
60	Health instrument and apparatus	-0.71	2.45	-0.12	0.27	-1.43	3.06
61	Precise and optics equipment, meter (all kinds)	1.15	1.60	0.83*	0.38	3.09*	1.58
72	Machinery used for broadcasting, television and information activities	-0.51*††	0.27	-0.05	0.07	-0.62*††	0.31
22	**Auto**	0.03†	0.42	0.70*	0.28	0.16†	0.32
63	Motor vehicles, motor bikes and spare parts	-0.02††	0.28	-0.08	0.08	-0.37†	0.45
67	Other special -purpose machinery	-0.66†	0.65	0.30*	0.15	-0.86†	0.55
68	Automobiles	2.41	1.38	0.57	0.38	0.57	0.38
23	**Oth M Mf**	0.63	0.38	0.39*	0.19	0.45	0.33
51	Health medicine	0.08††	0.12	0.08*	0.04	0.04††	0.10
69	Other transport mean	1.03	0.84	-0.22	0.13	-0.43	1.12
83	Products of printing activities	4.15	4.69	-1.88*	0.60	1.75	3.21
84	Products of publishing house	-2.08	2.17	-0.29*	0.13	-2.26	1.76

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table A5. Estimation Results for the First Difference Model and the Error Correction Model (ECM) for the Energy Import Sectors

Sector Code	Sector Name	First Difference Model		Error Correction Model			
		Transmission Coefficient (θ_k)	Std. Err.	Adjustment Coefficient (γ_k)	Std. Err.	Transmission Coefficient (θ_k)	Std. Err.
5	***Energy Import***	0.04††	0.08	-0.01	0.04	0.05††	0.09
24	**Electricity**	0.00††	0.09	0.12**	0.03	-0.01††	0.05
86	Gasoline, lubricants (already refined)	0.29†	0.25	0.33	0.19	0.29†	0.22
87	Electricity, gas	0.06††	0.03	0.03*	0.01	0.03††	0.03

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively; † and †† denote that the parameter is significantly different from one at 10% and 1% levels, respectively.

Table A6. Estimation Results for the Alternative Error Correction Models (ECM) with the Real Effective Exchange Rate (REER) and Wage Index for the Agricultural Export Sectors

Sector Code	Sector Name	ECM with REER	ECM with wage
		REER Coefficient	Wage Coefficient
1	***Agr Export***	0.06	-2.02**
1	**Rice**	0.23	-1.07
1	Paddy (all kinds)	-0.25	-2.81
35	Rice, processed	0.48	0.13
2	**Fish**	0.06	-2.91
14	Fishery	0.08	-3.49
15	Fish - Farming	0.26	-2.17
34	Processed seafood and by products	-0.15	-2.85
3	**Export**	0.06	0.69
2	Raw rubber	0.26	3.33
3	Coffee beans	0.12	1.70
5	Tea	-0.78*	-4.29*
32	Tea, processed	0.07	-2.42
4	**Process E**	0.28	-0.81
26	Processed and preserved fruits and vegetables	-0.13	-2.19
36	Other food manufactures	0.43	-1.34
52	Processed rubber and by products	0.18	-0.77
5	**Oth Crop**		
6	Other crops	-0.39	-5.52*

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.

Table A7. Estimation Results for the Alternative Error Correction Models (ECM) with the Real Effective Exchange Rate (REER), Wage Index, and Trade Policy for the Agricultural Import Sectors

Sector Code	Sector Name	ECM with REER	ECM with wage	ECM with tariff
		REER Coefficient	**Wage Coefficient**	**Tariff Coefficient**
2	***Agr Import***	0.15	-2.27**	4.33
6	**Sugar**	0.11	0.08	-24.10
4	Sugarcane	0.11	-1.85	-35.02
30	Sugar, refined	-0.16	-0.64	54.78
82	Animal feeds	0.04	-2.24	-67.38
7	**Meat**	-0.32	-6.80	-15.80
7	Pig (All kinds)	0.44	-11.13*	-76.64
8	Cow (All kinds)	-0.07	-5.97	-90.15
9	Poultry	-0.23	-2.07	-116.30
10	Other Livestock	-0.71*	-2.05	-120.04
22	Processed, preserved meat and by-products)	0.20	-1.15	-57.50*
9	**Process M**	0.34*	-0.83	49.90
23	Processed vegetable, and animals oils and fats	0.26	0.17	226.10*
24	Milk, butter and other dairy products	0.60*	-1.48*	48.92
25	Cakes, jams, candy, coca, chocolate products	-0.08	-0.91	1.85
27	Alcohol, beer and liquors	-0.29	-3.33	15.67
28	Beer and liquors	0.66*	0.08	3.80
29	Non-alcohol water and soft drinks	0.19	-2.31	-11.61
31	Coffee, processed	0.40	-2.43**	-9.64
33	Cigarettes and other tobacco products	0.20	0.01	11.97
80	Products of leather tanneries	0.80	-0.28	-10.32

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.

Table A8. Estimation Results for the Alternative Error Correction Model (ECM) with the Real Effective Exchange Rate (REER) and Wage Index for the Manufacturing Export Sectors

Sector Code	Sector Name	ECM with REER	ECM with wage
		REER Coefficient	Wage Coefficient
3	***Manf Export***	-0.08	-1.10
10	**Clothes**	0.60*	0.70
77	Ready -made clothes, sheets (all kinds)	0.68*	0.91
78	Carpets	-1.04	-0.13
79	Weaving and embroidery of textile -based goods (except carpets)	-0.56	0.10
11	**Leather**		
81	Leather goods	-0.69	-2.94
12	**Wood**		
44	Processed wood and wood products	-0.05	-4.51

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.

Table A9. Estimation Results for the Alternative Error Correction Models (ECM) with the Real Effective Exchange Rate (REER), Wage Index, and Trade Policy for the Manufacturing Import Sectors

Sector Code	Sector Name	ECM with REER	ECM with wage	ECM with tariff
		REER Coefficient	Wage Coefficient	Tariff Coefficient
4	***Manf Import***	0.00	-1.79**	0.81
13	**Oth pE Mf**	0.10	-0.63	92.28**
37	Glass and glass products	-0.51*	-1.43	59.73
38	Ceramic and by products	-1.13*	-1.47	756.30*
64	Bicycles and spare parts	-0.11	-0.61	31.96
65	General -purpose machinery	-0.12	-2.79	-67.07
66	Other general -purpose machinery	0.39	-1.83*	-30.52
70	Electrical machinery	-0.05	-2.05	-115.41
71	Other electrical machinery and equipment	0.52	-0.47	152.63
14	**Building**	0.17	-2.33	-13.73
39	Bricks, tiles	0.33	-3.00	92.76
40	Cement	0.32	-1.86*	-21.35
41	Concrete, mortar and other cement products	0.19	-3.83*	53.54
42	Other building materials	-0.06	-3.62	-116.07
15	**Paper**			
43	Paper pulp and paper products and by products	-1.08	-3.95	-8.02
16	**Chemical**	0.10	-0.31	215.99
45	Basic organic chemicals	0.12	-2.04	-107.02
46	Basic inorganic chemicals	-0.22	-0.52	33.82
47	Chemical fertilizer	0.25	-3.34	38.31
48	Fertilizer	-0.99	-3.16	125.68
49	Pesticides	-0.39	-2.31	-135.65
53	Soap, detergents	0.11	0.94	-70.65
54	Perfumes and other toilet preparation	0.23	-1.08	124.78
57	Paint	-0.22	-1.89	107.11
58	Inl, varnish and other painting materials	-0.15	-3.49	-14.91
59	Other chemical products	0.02	-2.82	-0.70

Table A9 continued

Sector Code	Sector Name	ECM with REER	ECM with wage	ECM with tariff
		REER Coefficient	Wage Coefficient	Tariff Coefficient
17	**Appliance**			
62	Home appliances and its spare parts	-0.58*	-0.93	141.51
18	**Plastic**	-1.06*	-2.73	289.20
55	Plastic (including semi-plastic products)	-1.31*	-4.65	299.46
56	Other plastic products	-0.29	-1.14	261.30
19	**Metals**	0.26	-0.21	444.42
73	Non-ferrous metals and products (except machinery equipment)	0.52	-0.06	18.49
74	Ferrous metals and products (except machinery equipment)	-0.20	0.21	-427.35
20	**Weaving**	0.19	-0.25	-88.85
75	Weaving of cloths (all kinds)	0.23	-0.25	9.08
76	Fibers, thread (all kinds)	0.50	0.48	-438.23*
21	**Machine**	0.08	0.26	-152.00
60	Health instrument and apparatus	0.61	0.27	381.81**
61	Precise and optics equipment, meter (all kinds)	-0.09	-0.31	-132.59*
72	Machinery used for broadcasting, television and information activities	0.05	0.31	-21.20
22	**Auto**	-0.10	-0.39	-13.45
63	Motor vehicles, motor bikes and spare parts	0.05	-0.08	-3.66
67	Other special -purpose machinery	0.03	-2.29**	57.55
68	Automobiles	0.11	-1.96	255.55*
23	**Oth M Mf**	0.07	-1.47	14.88
51	Health medicine	0.00	-2.37	-215.33
69	Other transport mean	-0.34*	0.88	83.65
83	Products of printing activities	0.43	-5.06*	-56.37
84	Products of publishing house	0.34	-0.70	-37.80

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.

Table A10. Estimation Results for the Alternative Error Correction Models (ECM) with the Real Effective Exchange Rate (REER), Wage Index, and Trade Policy for the Energy Import Sectors

Sector Code	Sector Name	ECM with REER	ECM with wage	ECM with tariff
		REER Coefficient	Wage Coefficient	Tariff Coefficient
5	***Energy Import***	-0.03	-1.20	-27.19
24	**Electricity**	0.53	-0.66	94.87
86	Gasoline, lubricants (already refined)	0.10	-1.54	-62.33
87	Electricity, gas	0.35	-0.80	246.53

Note: * and ** denote that the parameter is significantly different from zero at 10% and 1% levels, respectively.