In this paper, I will attempt to analyze how MRAs affect “horizontal” FDI relative to the relationship with exports: there exists the trade-off between horizontal FDI and exports, i.e., tariff jumping strategy vs. economies of scale. Recently the decision of how to serve foreign markets by Multinationals (MNEs) is becoming one of interesting issues in International Trade. MNEs can serve foreign markets by constructing production facilities overseas to avoid variable trade costs such as tariffs and transportation costs or they can have all production facilities in their home countries to realize economies of scale and choose to export their products to foreign countries. As a result, when trade costs decrease from MRAs, MNEs may concentrate their activities on one country and develop trade flows rather than open a plant in a foreign member country. As MNEs derive more benefits from economies of scale than tariff jumping strategies after conclusion of MRAs, the relative exports to horizontal FDI sales might increase.

To test this hypothesis, I have developed the theoretical framework which analyzes the relationship between exports and horizontal FDI sales in response to MRA as well as variable trade costs and wage difference between two countries, based on the work by Helpman, Melitz and Yeaple (HMY, 2004). From a consumer’s CES preferences over a continuum of differentiated goods and the monopolistically competitive market in which each firm
produces a different variety, the relative values of export to FDI in the foreign market is defined as follows:

\[ \frac{V_X}{V_F} = \tau^{1-\sigma} \left( \frac{1}{\omega} \right)^{\gamma} \left[ \frac{f_F - f_X}{(\tau^{\sigma-1} - 1)f_X} \right]^\varepsilon - 1 \]

where \( V_X \) and \( V_F \) are the values of export and FDI, respectively, \( \sigma \) is the elasticity of substitution across goods, \( \tau > 1 \) is a per-unit iceberg cost for exporting such as transportation costs, insurance fees and tariffs, \( f_X \) and \( f_F \) are fixed costs for export and FDI, respectively, and \( \omega, \gamma \) and \( \varepsilon \) represent other industry or country characteristics.

As in Beller (2007) and Hogan & Hartson (2003), an MRA will be modeled as a drop in fixed costs of exporting, \( f_F \). Hence the expression for the relative values of export to FDI implies \( \frac{\partial(V_X)}{\partial f_X} < 0 \), implying that when a domestic country concludes an MRA with a foreign country, its relative values of export to FDI will increase.

I have empirically tested the theoretical results with U.S. multinationals’ affiliate sales and exports in 8 countries and 7 manufacturing sectors during the period 1999-2006. Four econometric specifications were set up for this treatise: the fixed effects model, the constant treatment effects model and two specifications of the time-varying treatment effects model. Both constant treatment effects and the time-varying treatment effects models are in the group of the Difference-in-Difference (DID) estimator.

The fixed effects model is defined as follows:

\[ Y_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 WAGE\_DIFF_{it} + \beta_3 TARIFF_{ijt} (or \beta_3 DUTY_{ijt}) + \beta_4 CHARGES_{ijt} + \beta_5 MRA_{ijt} + \gamma_i + \delta_j + \tau_t + \varepsilon_{ijt} \]
i, j, t refer to foreign countries, industries and years, respectively. $Y_{ijt}$ is the dependent variable, which represents the log of the relative values of U.S. exports to U.S. multinational affiliate sales for industry $j$ in country $i$ at year $t$. $GDP_{it}$ is the log of country $i$’s GDP at year $t$. $WAGE\_DIFF_{it}$ is the log of per capita GDP difference between the U.S. and country $i$ at year $t$. $CHARGES_{ijt}$ is the log of country $i$’s aggregate costs which consist of all freight, insurance and other charges for industry $j$ in the U.S. at year $t$.

$TARIFF_{ijt}$ is the log of the weighted tariff rate for industry $j$ in country $i$ at year $t$. $DUTY_{ijt}$ is the log of the estimated duty of goods imported into the U.S. for industry $j$ from country $i$ at year $t$. To estimate the effects of various sector-level tariff rates on the dependent variable I have replaced $TARIFF_{ijt}$ with $DUTY_{ijt}$ in some regressions.

The key variable, $MRA_{ijt}$, is a dummy variable which is 1 after an MRA is entered into force with country $i$ in industry $j$ at year $t$; and 0 otherwise. $\gamma_i$, $\delta_j$ and $\tau_t$ denote country-fixed effects, industry-fixed effects and year-fixed effects, respectively. Finally, $\epsilon_{ijt}$ is an unobserved error term.

Based on theoretical results, I expect $MRA_{ijt}$ to have positive effects on $Y_{ijt}$.

One important concern about the fixed effects model is the endogenous problem. To solve this the DID estimation is a useful instrument for isolating the effects of a treatment (i.e., MRA) from those of other unobservable characteristics on the dependent variable. It is based on a comparison of outcomes in the treated group with those in the control group before and after the treatment. Hence there are two differences at the same time: the first one is whether it is treated or not (cross sectional variation), and the second one is whether it is pre- or post-treatment (time series variation).

For the first difference, I divided all industries into two groups: the treated group and the control group. The treated group consists of U.S. industries which signed an MRA during the
sample period, 1999-2006. The control group consists of industries which signed an MRA before 1999 or never signed any MRA during the sample period. Second, since the U.S. has not signed an MRA with other countries in the same year, it is impossible to define with certainty whether the second difference represents pre- or post-treatment. To solve this problem, Giavazzi and Tabellini (2005)’s methods were used as benchmarks, placing the DID estimator within the framework of the panel analysis.

Therefore, the constant treatment effects model of the DID estimator is:

\[ Y_{ijt} = \beta_0 + \beta_1 X_{i(j)t} + \beta_2 TREAT_{ijt} + \gamma_t + \delta_j + \tau_t + \varepsilon_{ijt} \]

As before, \( Y_{ijt} \) and \( \varepsilon_{ijt} \) denote the log of the relative values of U.S. exports to U.S. multinational affiliate sales and an unobserved error term, respectively. \( TREAT_{ijt} \) is a dummy variable which is 1 in years after the entry into force of the MRA in the treated group and 0 otherwise. Therefore, both the treated group before the entry into force of an MRA and the control group have zero values of \( TREAT_{ijt} \) in the regression.

Also included here is a set of other control variables, \( X_{i(j)t} \), and three dummies, \( \gamma_t \), \( \delta_j \) and \( \tau_t \) to control unobserved heterogeneity affecting the dependent variable of the treated group and the control group differently. \( X_{i(j)t} \) consists of explanatory variables in the fixed effects model excluding \( MRA_{ijt} \).

\( \beta_2 \) is expected to be a positive sign, which implies that the treatment affects positively the relative values of U.S. exports to U.S. multinational affiliate sales in the treated group after the entry into force of the MRA compared with those in the control group over the same time period.

In some cases, it would take some years for an MRA to influence the relative values of U.S.
exports to U.S. multinational affiliate sales. In other cases, there would be *ex ante* effects of MRA on the relative values of U.S. exports to U.S. multinational affiliate sales, as firms anticipate change. To control these timed effects of the treatment, estimates were derived using the first time-varying treatment effects model of the DID estimator, following Giavazzi and Tabellini (2005):

\[
Y_{ijt} = \beta_0 + \beta_1 X_{(i)jt} + \beta_2 \text{TREAT}_3Y_{\text{PRE}_{ijt}} + \beta_3 \text{TREAT}_3Y_{\text{POS}_{ijt}} + \beta_4 \text{TREAT}_4Y_{\text{ON}_{ijt}} + \\
\gamma_i + \delta_j + \tau_t + \epsilon_{ijt}
\]  

(29)

\(Y_{ijt}, X_{(i)jt}, \gamma_i, \delta_j, \tau_t\) and \(\epsilon_{ijt}\) are the same as in (28). \(\text{TREAT}_3Y_{\text{PRE}_{ijt}}\) is a dummy variable which is 1 in the three preceding years before the entry into force of the MRA and 0 otherwise. \(\text{TREAT}_3Y_{\text{POS}_{ijt}}\) is a dummy variable which is 1 in the year of the entry into force of the MRA and two following years. \(\text{TREAT}_4Y_{\text{ON}_{ijt}}\) is a dummy variable which is 1 from the third year onward after the entry into force of the MRA. Hence, \(\text{TREAT}_3Y_{\text{PRE}_{ijt}}\) represents *ex ante* effects of MRA on the dependent variable, while both \(\text{TREAT}_3Y_{\text{POS}_{ijt}}\) and \(\text{TREAT}_4Y_{\text{ON}_{ijt}}\) represent *ex post* effects of the MRA on the dependent variable.

Following Laporte and Windmeijer (2005), the second time-varying treatment effects model of the DID estimator is:

\[
Y_{ijt} = \beta_0 + \beta_1 X_{(i)jt} + \beta_2 \text{TREAT}_{ijt} + \beta_3 \text{TREAT}_4Y_{\text{LAG}_{ijt}} + \beta_4 \text{TREAT}_3Y_{\text{LAG}_{ijt}} + \cdots + \\
\beta_6 \text{TREAT}_1Y_{\text{LAG}_{ijt}} + \beta_7 \text{TREAT}_0Y_{ijt} + \beta_8 T \otimes E \otimes A \otimes T \otimes Y_{\text{LEAD}_{ijtijt}} + \\
\beta_9 \text{TREAT}_2Y_{\text{LEAD}_{ijt}} + \cdots + \beta_{15} \text{TREAT}_8Y_{\text{LEAD}_{ijt}} + \gamma_i + \delta_j + \tau_t + \epsilon_{ijt}
\]

(30)
$Y_{ijt}$, $X_{i(j)t}$, $TREAT_{ijt}$, $\gamma_i$, $\delta_j$, $\tau_t$ and $\epsilon_{ijt}$ are the same as before. $TREAT_kY\_LAG_{ijt}$ is a dummy variable which is 1 in the $k$-th year before the entry of the MRA into force and 0 otherwise ($k=1,2,\ldots,4$). $TREAT_dY\_LEAD_{ijt}$ is a dummy variable which is 1 in the $d$-th year after the entry of MRA into force and 0 otherwise ($d=1,2,\ldots,8$). $TREAT_0Y_{ijt}$ is a dummy variable which is 1 in the year of the entry of the MRA into force. Therefore, $TREAT_kY\_LAG_{ijt}$ and $TREAT_dY\_LAG\_LEAD_{ijt}$ represent ex ante effects and ex post effects of MRA on the dependent variable, respectively.

The key fact found and established by these empirical tests is that MRAs have positive effects on the relative U.S. exports to horizontal FDI, while trade variable costs have negative effects. The results are robust for another specification of industry-fixed effects, that is, the industry-specific time trends, and standard errors which are clustered by industry, country and year-level. Hence, the empirical results are consistent with those from the theoretical model.