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NTM harmonization, profits, and productivity: Firm-level evidence from Morocco

Patricia Augier / Olivier Cadot / Marion Dovis

We explore the effect of North-South harmonization on firm profits and productivity in the context of Morocco's regulatory convergence with the E.U.. We formalize the intuition on harmonization's effects in a Melitz model following Demidova and Rodriguez-Clare (2011) and show that it affects equilibrium outcomes through changes in domestic vs. international relative trade costs. The model highlights both trade-creation effects, through reduced trade costs with the preferential partner, and trade-diversion effects, through higher export costs for out-of-region exporters. Combining a novel dataset on harmonization measures at the product level with Morocco's industrial survey, DID estimation with firm fixed effects suggests that the trade-diversion effect dominates, raising operating profits and labor productivity in particular in sectors exposed to Southern low-cost competition. This suggests that for the Southern country, "shutting the door to the low-cost producers" may be a political-economy motivation to accept harmonization on stiff Northern standards.

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1. Introduction

Is it a good thing for developing countries to harmonize technical and sanitary regulations on stiff Northern standards? On the one hand, harmonized standards can enhance competition by reducing artificial barriers to market access and reduce information asymmetries between producers and consumers. On the other hand, "upward harmonization" on Northern standards extends the cost of complying with those standards to domestic-market sales, changing the terms of competition in complex ways. Given that many regional integration agreements (RIA) strive for "deep" integration involving the harmonization of standards, understanding its effects is a key issue for policymakers, especially in developing countries. However, guidance from theory and empirics is limited.

In a heterogeneous-firms setting, the effect of harmonization with a partner is channeled through several effects, two of which play against one another. First, note that when country *i* harmonizes its legislation with country *j*, the cost of exporting from *i* to *j* is unaffected, because with or without harmonization, exporting to *j* means satisfying *j*'s standards; so the change is not there. The change is on *i*'s domestic market, where the "internal trade cost" rises, as *i* now imposes *j*'s (stiffer) standard on its home market. Thus, while the absolute cost of exporting to partner *j* remains unchanged, the *relative* cost shrinks.

The two key conflicting effects play out in *i*'s market. On one hand, *j*'s exporters, who already met the standard before harmonization, are no longer at a competitive disadvantage when selling on *i*'s market, since now even *i*'s domestic produces must meet it. Thus, competition is intensified, raising the minimum productivity cutoff of domestic sellers. On the other hand, the stiffer standard now in force on *i*'s market raises the cost of exporting to *i* from third countries, reducing competition on *i*'s market through trade diversion. This has an anti-competitive effect on *i*'s market, pushing down the minimum productivity of domestic producers. Depending on the relative strength of the two effects—an empirical question—harmonization can have a pro- or anti-competitive net effect.

In a richer setting with market failures and bounded rationality, harmonization could also affect firm productivity and profits through channels other than selection and general-equilibrium effects. For instance, it could contribute to overcome market failures due to information asymmetries, making quality claims more credible. When coming with technical assistance—through programs such as the E.U.'s upgrading program in Mediterranean countries—it could also help overcome management failures, by improving information on best practices and modern technology.

Although fragmentary, evidence on the effect of harmonization on developing countries suggests that harmonization can have trade-enhancing effects, at least when international standards are used. For instance, Chen and Mattoo (2004) showed in a gravity equation that harmonization on regional standards improved market access for out-of-bloc exporters if they were from industrial countries, but reduced it if they were from developing countries. Disdier et al. (2012) found that harmonization as part of North-South RIAs could reinforce hub-and-spoke trade structures at the expense of South-South trade, as harmonization at stringent Northern levels raised costs for Southern producers and could price them out of other Southern markets where strict standards would not confer any competitive edge.

In one of the few studies using firm-level data,[1] Reyes (2012) showed that the harmonization of E.U. electronics standards triggered the entry of new U.S. exporters, but that the tougher competitive environment crowded out Southern exporters, confirming Chen and Mattoo's earlier result on aggregate data. Wilson, Otsuki and Majumdsar (2003) estimated that harmonizing E.U. antibiotics regulations for bovine meat on the Codex Alimentarius standard would benefit South African, Brazilian and Argentine beef exporters. Mangelsdorf, Portugal-Perez and Wilson (2012) showed that the harmonization of Chinese standards on international ones helped Chinese exporters overcome reputation problems. Finally, using a cross-section of firms from 59 countries, Goedhuys and Sleuwagen (2013) found that international standards certification raised productivity and turnover.[2]

In most studies, especially those using aggregate data, the channels through which harmonization affects market structure are black-boxed, as little is known of the within-firm effects of standards harmonization. We try to extent this literature by estimating how the harmonization of Morocco's regulations on E.U. standards affected productivity and profits at the firm level.

Morocco is an interesting case study because it was the first country to obtain the E.U.'s "advanced status" granted on the basis of regulatory convergence to E.U. regulations. The process was largely mandated by the Association Agreement with the E.U., which stipulated that:

> "[t]he Parties shall cooperate in developing: (a) the use of Community rules in standardisation, metrology, quality control and conformity assessment; (b) the updating of Moroccan laboratories, leading eventually to the conclusion of mutual recognition agreements for conformity assessment; (c) the bodies responsible for intellectual, industrial and commercial property and for standardisation and quality in Morocco."[3]

As convergence toward E.U. regulations is expected of other E.U. partners as well, Morocco provides a convenient laboratory to test its effects. Moreover, as Morocco's regulations prior to harmonization were largely outdated and unevenly enforced, there is a reasonable presumption that new (harmonized) regulations were stricter, *de jure* or *de facto*, than the old ones they replaced.

We explore these effects by combining firm-level panel data from Morocco's manufacturing census with data on the harmonization of Morocco's non-tariff measures (NTMs). The data on non-tariff measures comes from a new wave of data collection on NTMs carried out as part of a joint effort by UNCTAD, the African Development Bank, and the World Bank while one of the authors was at the World Bank. The regulatory data includes all trade-relevant regulations (technical regulations, sanitary and phytosanitary measures, prohibitions, quantitative restrictions, and so on) coded

[1] Other papers using firm-level data include Chen, Otsuki and Wilson (2006) who used a World Bank survey of 619 companies in 17 developing countries to explore the impact of NTMs on export markets, with information on NTMs also obtained from the same survey. Firm-level data (from the Amadeus database) was also used in an NTM context by Konings and Vandenbussche (2005) to explore the effect of antidumping measures on the markups of European firms.

[2] The international standards certification data used by Godehuys and Sleuwagen was from the World Bank's Investment Climate Surveys; that is, they were based on the companies' survey responses and included non-governmental certifications like ISO.

[3] Morocco-EU Association Agreement, Article 51. See http://eeas.europa.eu/morocco/association _agreement / index_en.htm.

according to the 2009 MAST nomenclature for NTMs.[4] The data is combined with Morocco's rich manufacturing survey which provides a wealth of information on firm characteristics including, inter alia, costs, employment, and turnover.

Our identification strategy exploits the fact that Morocco's NTM harmonization has largely proceeded in discrete waves whose dates varied across sectors. The panel nature of our census data allows us to track the differential effect of harmonization waves on productivity and profits across sector-years while controlling for both firm and time effects.

We find evidence of trade-diversion effects on Morocco's domestic market, as harmonization raised productivity and profits more strongly in sectors where import penetration by developing-country exporters was higher, and less in sectors where import penetration by OECD exporters was higher. That is, our results suggest that harmonization helped shelter Moroccan producers from competition from low-cost exporters, while exposing them more to E.U. competition.

On net, the effect of harmonization on productivity and profits was unambiguously positive and highly significant. Our results seem to suggest that in the case of Morocco, harmonization (i) raised labor productivity (through enhanced efficiency or capital deepening); (ii) raised profits; (iii) sheltered Moroccan firms from Southern low-cost competition; and (iv) exposed them to competition from industrial-country exporters.

The paper is organized as follows. Section 2 formalizes the intuition using a heterogeneous-firms model following closely the treatment of Demidova and Rodriguez-Clare (2011). Section 3 describes the data and estimation issues. Section 4 presents baseline, extended and robustness results. Section 5 concludes.

2. An illustrative model

The effect of harmonization to stricter standards on profits is complex, as it involves a rise compliance costs for sales on the domestic market for both domestic producers and out-of-bloc exporters. In order to guide the intuition, we present here a comparative-statics exercise in which we attempt to disentangle these effects. As the algebra in a heterogeneous-firms model becomes quickly intricate, we do not attempt to build a full three-country model with a regional and an out-of-region partner; instead, we run two separate comparative-statics experiments.

Let the three countries be Morocco (m), the E.U. (e) and China (c), and suppose that Morocco harmonizes its standards with stiffer E.U. ones. In both experiments, the home country is Morocco. In the first, the partner country is China, for whom Morocco's harmonization with the E.U. means complying with a stiffer standard, which raises the cost of export.[5] Letting τ_{ij} be the cost of selling in market j from market i (possibly the same), τ_{mm} goes up as Moroccan producers now have to

[4] The 2009 MAST nomenclature has been revised in 2012 as part of an effort to harmonize codes between the new data and the WTO's notifications system, but Morocco's data uses the 2009 codes.

[5] We model the effect of stiffer standards as a rise in the marginal rather than the fixed cost of production. For instance, complying with EU fireproofness standards for electric insulation material means using certain intermediates which are more expensive than others; the same applies to food plastic containers, and so on. Some standards may imply the use of more sophisticated capital equipment, in which case the fixed cost also rises. We leave the exploration of changes in the fixed cost of production for future research (see Demidova and Rodriguez-Clare (2011) on this).

comply with the E.U. standard, and τ_{cm} also goes up because Chinese exporters selling on the Moroccan market have to comply as well. The cost of exporting to China, τ_{mc}, is unchanged. In the second experiment, the partner country is the E.U.. Trade costs are unchanged both ways (as Moroccan producers selling on E.U. markets had to comply even before harmonization and E.U. producers were compliant on their home market), so only τ_{mm} rises while both τ_{me} and τ_{em} remain unchanged. We explore these effects in a stripped-down, two-country Melitz model, following closely the treatment in Demidova and Rodriguez-Clare (2011, henceforth DRC). We slightly modify the model in order to allow τ_{ii} to vary alongside trade costs as domestic regulatory standards are altered. Although the gist of the model remains the same, the algebra of the equilibrium needs to be slightly rewritten and comparative statics change. We briefly re-state the model here in order to highlight where the formulation changes while omitting proofs when they remain the same.

2.1 Base model

Consider two countries, home ($i = 1$) and foreign ($i = 2$), with L_i identical households, each of which supplies one unit of labor. The wage rate is w_i. Preferences are Dixit-Stiglitz with elasticity of substitution σ over a continuum of varieties. The sunk cost of entry is F in both countries and the fixed cost of production in country i for country j is f_{ij}, both in terms of local labor (so firms pay $w_i F$ and $w_i f_{ij}$). Each country has M_i firms with random productivity z drawn from distributions $G_i(z)$. The marginal cost, for a firm located in i, to sell in j, is $w_i \tau_{ij} / z$, where τ_{ij} is an iceberg-type cost. Contrary to the standard treatment, we will not constrain τ_{ii} to be one because we will proxy a stiffening of i's domestic standards as a rise in τ_{ii} accompanied, for some partners, by a rise in τ_{ji}. Finally, let $\rho = (\sigma - 1)/\sigma$. For a firm with productivity z selling in country j from country i, optimal pricing entails a constant markup ρ over marginal cost, i.e.

$$p_{ij}(z) = \frac{w_i \tau_{ij}}{\rho z}; \tag{1}$$

revenue is

$$r_{ij}(z) = R_j P_j^{\sigma-1} p_j^{1-\sigma} \tag{2}$$

where R_j is aggregate expenditure in destination country j, and operating profit is

$$\pi_{ij}(z) = \frac{r_{ij}(z)}{\sigma} - w_i f_{ij}. \tag{3}$$

The value of z at which (3) is zero, z_{ij}^*, is the minimum-productivity cutoff for a firm in i to sell in j. Using (1) and (2), it can be written implicitly as

$$R_j P_j^{\sigma-1}\left(\frac{w_i\tau_{ij}}{\rho z_{ij}^*}\right)^{1-\sigma} \equiv \sigma w_i f_{ij}. \tag{4}$$

The price index in country *j* is

$$P_j^{\sigma-1} = \sum_{i=1}^{2} M_i \int_{z_i^*}^{\infty} p^{1-\sigma} dG_i(z) = \sum_{i=1}^{2} M_i \int_{z_i^*}^{\infty} \left(\frac{w_i\tau_{ij}}{\rho z}\right)^{1-\sigma} dG_i(z). \tag{5}$$

Free entry implies that expected profits just match entry costs, or

$$\sum_j \left[\int_{z_{ij}^*}^{\infty} \pi_{ij}(z)\, dG_i(z)\right] = w_i F. \tag{6}$$

Define a new function

$$J\left(z_{ij}^*\right) = \int_{z_{ij}^*}^{\infty} \left[\left(\frac{z}{z_{ij}^*}\right)^{\sigma-1} - 1\right] dG_i(z); \tag{7}$$

after some manipulation, (6) can be expressed as

$$\sum_j f_{ij} J_i\left(z_{ij}^*\right) = F. \tag{8}$$

Country *i*'s total export revenue on market *j*, integrated over all firms active on that market, is

$$X_{ij} = M_i \int_{z_{ij}^*}^{\infty} r(z)\, dG_i(z) = M_i \int_{z_{ij}^*}^{\infty} \left(\frac{z}{z_{ij}^*}\right)^{\sigma-1} \sigma w_i f_{ij}\, dG_i(z) \tag{9}$$

where the second part uses (2) and (4). Using the definition of J in (7), it can be rewritten as

$$X_{ij} = M_i\left[J_i\left(z_{ij}^*\right) + 1 - G_i\left(z_{ij}^*\right)\right]\sigma w_i f_{ij}. \tag{10}$$

Trade balance implies $X_{ij} = X_{ji}$ or

$$M_1\left[J_1\left(z_{12}^*\right) + 1 - G_1\left(z_{12}^*\right)\right]\sigma w_1 f_{12} = M_2\left[J_2\left(z_{21}^*\right) + 1 - G_2\left(z_{21}^*\right)\right]\sigma f_{21}. \tag{11}$$

2.2 Equilibrium

We now characterize the equilibrium in a two-country setting where country 1 sets standards on the domestic market in a way that generates variable costs $\tau_{11} > 1$ for domestic producers and $\tau_{21} > 1$ for country-2 firms exporting to country 1. Trade costs for country-2 firms selling on their home market are assumed away, so $\tau_{22} = 1$. There are nine endogenous variables: M_i, z_{ii}^*, z_{ij}^*, P_i, and w_1 after setting labor in country 2 as the numeraire (so $w_2 = 1$). The model's equations are the two free-entry conditions (8), four productivity cutoffs of the form (4), two price-index equations (5), and trade balance (11). The productivity cutoff for country-1 exporters is

$$R_2 P_2^{\sigma-1}\left(\frac{\tau_{12} w_1}{\rho z_{12}^*}\right)^{1-\sigma} = \sigma w_1 f_{12} \tag{12}$$

while for country-2 firms selling on their own market, it is

$$R_2 P_2^{\sigma-1}\left(\frac{1}{\rho z_{22}^*}\right)^{1-\sigma} = \sigma f_{22} \tag{13}$$

Taking the ratio of the two yields

$$z_{12}^* = \tau_{12}\left(\frac{f_{12}}{f_{22}}\right)^{\frac{1}{\sigma-1}} w_1^{1/\rho} z_{22}^* = h_{12}(\tau_{12}, w_1) z_{22}^*. \tag{14}$$

Similarly, the productivity cutoff for country-2 exporters is

$$R_1 P_1^{\sigma-1}\left(\frac{\tau_{21}}{\rho z_{21}^*}\right)^{1-\sigma} = \sigma f_{21} \tag{15}$$

while for country-1 firms selling at home, it is

$$R_1 P_1^{\sigma-1}\left(\frac{\tau_{11} w_1}{\rho z_{11}^*}\right)^{1-\sigma} = \sigma w_1 f_{11}; \tag{16}$$

taking again the ratio of the two gives

$$z_{21}^* = \frac{\tau_{21}}{\tau_{11}}\left(\frac{f_{21}}{f_{11}}\right)^{\frac{1}{\sigma-1}} w_1^{-1/\rho} z_{11}^* = h_{21}\left(\frac{\tau_{21}}{\tau_{11}}, w_1\right) z_{11}^*. \tag{17}$$

Note that (8) pins down z_{11}^* as an implicit function of z_{12}^* and z_{22}^* as a function of z_{21}^*. Denote these functions respectively by $\zeta_{11}\left(z_{12}^*\right)$ and $\zeta_{22}\left(z_{21}^*\right)$, with $\zeta_{11}' < 0, \quad \zeta_{22}' < 0$. Combining these with (14) and (17), the minimum productivity cutoff for country-1 exporters can be expressed as a fixed point of the function

$$z_{12}^* = h_{12}(\tau_{12}, w_1)\zeta_{22}\left[h_{21}\left(\frac{\tau_{21}}{\tau_{11}}, w_1\right)\zeta_{11}\left(z_{12}^*\right)\right]. \tag{18}$$

This fixed point depends on country 1's wage rate w_1 and trade (domestic and international) costs τ_{11}, τ_{12} and τ_{21}. Expressed in $\left(z_{12}^*, w_1\right)$space with trade costs as parameters, it is what DRC called the CC curve, and by differentiation it can be shown to be upward-sloping.[6]

The trade-balance equation closes the model. Substituting in the h and ζ functions, it can also be rewritten implicitly as a fixed point of z_{12}^*, with w_1 and trade costs as parameters:

[6] See DRC's appendix.

$$J_1\left(z_{12}^*\right)+1-G_1\left(z_{12}^*\right)=\frac{M_2}{M_1}\frac{f_{21}}{f_{12}}w_1^{-1}\left\{J_2\left[h_{21}\left(\frac{\tau_{21}}{\tau_{11}},w_1\right)\zeta_{11}\left(z_{12}^*\right)\right]+1-G_2\left[h_{21}\left(\frac{\tau_{21}}{\tau_{11}},w_1\right)\zeta_{11}\left(z_{12}^*\right)\right]\right\} \quad (19)$$

Chain-rule differentiation shows that the resulting TB curve is downward-sloping, so the intersection of the CC and TB curves pins down a unique $\left(z_{12}^*,w_1\right)$ equilibrium pair.

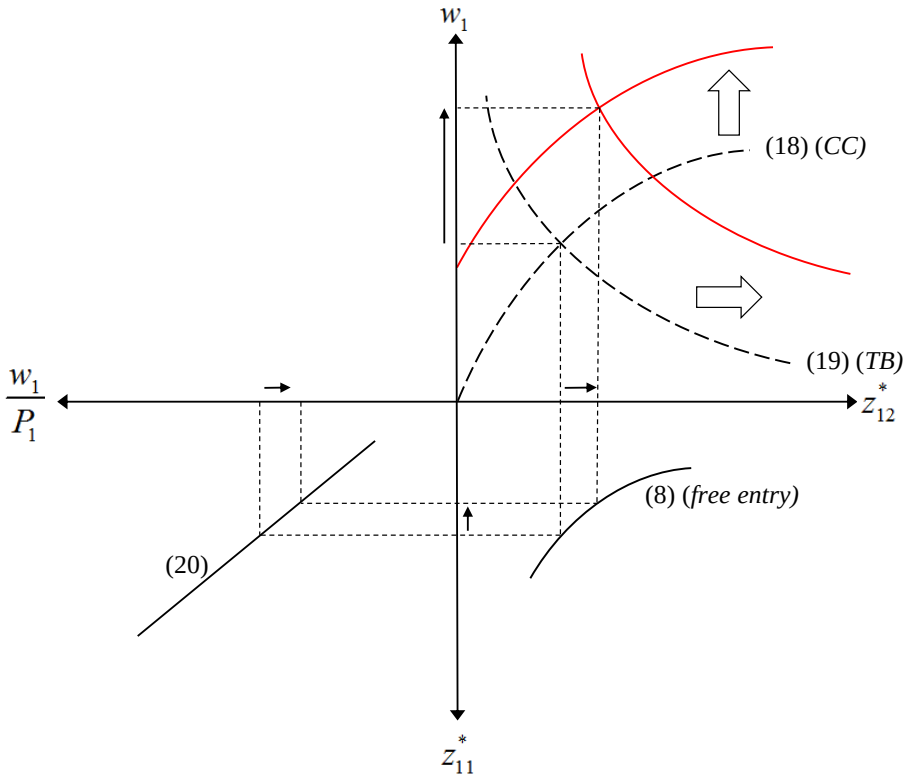
2.3 Comparative statics

2.3.1 Trade with a non-regional partner

Large country

We start with the first experiment, where country 1 adopts stiffer standards raising τ_{11} and τ_{21} in the same proportion by a non-discriminatory product standard that raises the marginal cost of production (e.g. by mandating the use of certain non-polluting intermediates). As h_{21} is homogenous of degree zero in τ_{11} and τ_{21} together, neither the CC curve nor the TB one move, and the equilibrium is unchanged. Thus, a non-discriminatory standard does not affect the domestic market equilibrium, even though foreign producers face a higher cost of selling on the domestic market.

Figure 1
Comparative statics of a trade-restricting rise in domestic standards



Next, suppose that the standard is tougher to meet for foreign producers than for domestic ones—say, because it forces foreign producers to run several separate batches to meet different standards to different export destinations. Then τ_{21}/τ_{11} rises, and the effect is similar to a unilateral trade *restriction*. That is, both CC and TB curves shift up (upper quadrant of Figure 1), and both w_1 and z_{12}^* rise.[7] As z_{11}^* and z_{12}^* move in opposite directions along (8), z_{11}^* shrinks (lower RHS quadrant of Figure 1). As z_{11}^* shrinks and τ_{11} rises, the real wage, which, using (4) and noting that $R_1 = w_1 L_1$, can be written as

$$\frac{w_1}{P_1} = \left(\frac{L_1}{\sigma f_{11}}\right)^{\frac{1}{\sigma-1}} \frac{\rho z_{11}^*}{\tau_{11}} \tag{20}$$

also shrinks (LHS of Figure 1). The combined effect of changes in the price level and wage rate on the operating profits of firms selling on the domestic market is

$$d\pi_{11} = \frac{1}{\sigma}\frac{\partial r_{11}}{\partial P_1} dP_1 - f_{11} dw_1. \tag{21}$$

For any firm with $z > z_{11}^*$, by (4)

$$\frac{\partial r_{11}}{\partial P_{11}} = (\sigma - 1)\frac{R_1 P_1^{\sigma-1} p_1^{1-\sigma}}{P_1} > \frac{\sigma-1}{P_1}\sigma w_1 f_{11}; \tag{22}$$

using this,

$$\begin{aligned} d\pi_{11} &> (\sigma-1) f_{11}\frac{w_1}{P_1}\frac{dP_1}{dw_1} dw_1 - f_{11} dw_1 \\ &= \left[(\sigma-1)\frac{w_1}{P_1}\frac{dP_1}{dw_1} - 1\right] f_{11} dw_1 \end{aligned} \tag{23}$$

which is positive for any value of σ larger than $1+1/\varepsilon_{11}$ where ε_{11} is the elasticity of the price level to the wage rate in **Error! Reference source not found.**. It is larger than one since a rise in w_1 is associated with a decline in w_1/P_1. For instance, $\sigma = 2$ is sufficient to ensure that operating profits rise for domestic firms. This is what we will test in the empirical part.

Small country

If country 1 is small, M_2, P_2 and z_{22}^* are exogenous. For our purposes, the main change is that $\zeta_{22}' = 0$, so (18) reduces to

[7] This is shown again by differentiation of (18) and (19) in DRC's appendix. The graphical analysis alone is not sufficient to establish that z_{12}^* rises.

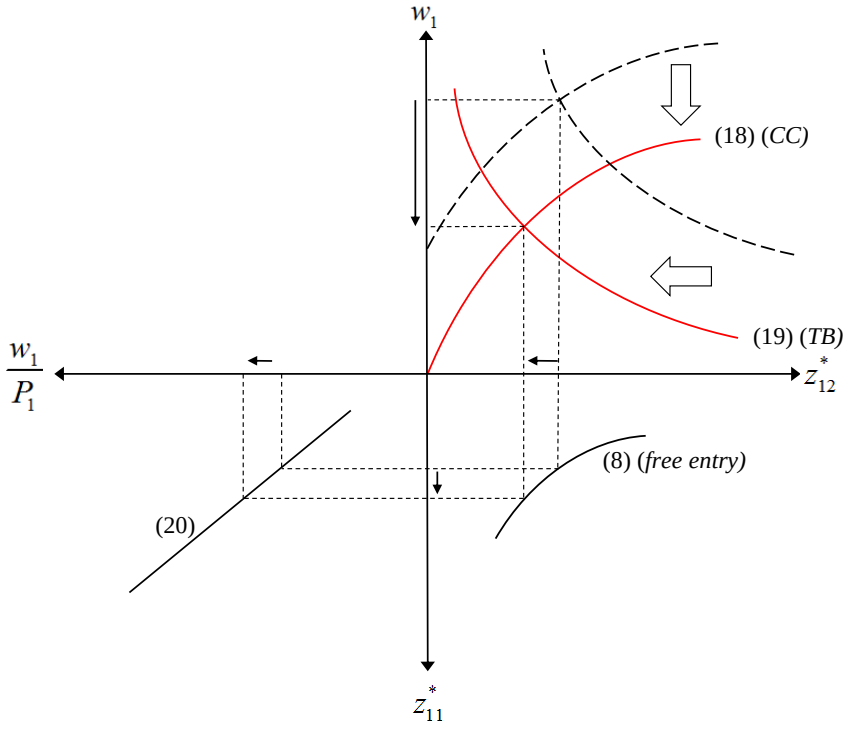
$$z_{12}^{*} = h_{12}\left(\tau_{12}, w_1\right) z_{22}^{*}. \tag{24}$$

That is, the minimum productivity cutoff for exporters z_{12}^{*} is no longer determined by a fixed point, but simply as a function of τ_{12} and w_1. Given the shape of the h function, the CC curve is still upward-sloping in $\left(z_{12}^{*}, w_1\right)$ space, but now a rise in τ_{11} leaves it unchanged. The TB curve is still determined by (19) and, as before, rises with a rise in τ_{11}. Thus, both τ_{12} and w_1 rise, and even though only one curve moves in Figure 1, the comparative-statics remain qualitatively the same. In particular, profits still rise.

2.3.2 Trade with a regional partner

Suppose now that the trade cost of foreign exporters, τ_{21}, remains unchanged as a result of the stiffer standard in country 1 because they already had to comply with that standard at home. This is the case of a regional partner like the E.U. for Morocco. Then τ_{21} / τ_{11} shrinks, and the analysis is reversed compared to the previous section. That is, the rise in τ_{11} (domestic sales costs) reduces relative trade costs (τ_{21} and τ_{12}) so harmonization acts like a unilateral liberalization, and the comparative statics is as shown in Figure 2.

Figure 2
Effect of harmonizing country 1's domestic standards with those of country 2



In that case, z_{11}^{*} goes up, the real wage goes up, and profits go down.

Small-country case

In the small-country case, again the CC curve does not move, but the comparative-statics effects are qualitatively the same. That is, even though conditions on the foreign market (P_2, M_2 and z_{22}^*) are not affected by country 1's harmonization, z_{12}^* rises through general-equilibrium effects playing out on country 1's market as a result of the rise in the domestic trade cost τ_{11} relative to international trade costs.

To sum up, in a Melitz model, the effect of harmonization rests on the evolution of domestic vs. international trade costs:

a) A stiffer standard with the same effect on the marginal costs of domestic and foreign producers has no effect on the former's profitability;

b) A stiffer standard with a stronger effect on the marginal costs of foreign producers acts like a trade restriction, i.e. (i) raises the minimum-productivity cutoff (MPC) of foreign exporters, (ii) reduces the MPC of domestic producers on the home market, (iii) raises the MPC of domestic exporters on the foreign market, (iv) reduces the domestic real wage, and (v) raises the profits of domestic producers.

c) A standard that is harmonized upward to that of a partner country acts like a trade liberalization, i.e. (i) reduces the MPC of foreign exporters, (ii) raises the MPC of domestic producers on the home market, (iii) reduces the MPC of domestic exporters on the foreign market, (iv) raises the domestic real wage, and (v) reduces the profits of domestic producers.

In the context of Morocco's standards harmonization with the E.U., we now explore in manufacturing-census data whether the evolution of operating profits seems consistent with intuition as formalized in the model above.

3. Data and estimation

3.1 The data

Our firm data comes from the Moroccan annual manufacturing census (*Enquête industrielle*) for 1985-2004, which contains data on turnover, value added, exports, employment, date of creation, and investment. It uses 4-digit industry codes from the Moroccan Nomenclature of Economic Activities, which is close to ISIC-4 and can easily be reconciled with it. We deflated production and value added with sector-level price indices. The raw dataset contains 8'337 firms. After applying Hall and Mairesse's procedure for cleaning this type of data (Hall and Mairesse 1995), we are left with 8'191 firms.

Our outcome variables are real labor productivity and the markup over labor costs. Labor productivity is calculated as value added per permanently-hired employee. The markup is gross operating income over sales, where gross operating income is value added minus payroll. That is, let i index firms and j sectors, with $j(i)$ designating the sector to which i belongs. If v_{it} is value added, Y_{it} sales, $w_{it}L_{it}$ payroll, Q_{it} labor productivity, π_{it} the markup over labor costs, and p_{jt} an ISIC-2 deflator, our two alternative dependent variables are real labor productivity defined as

$$q_{it} = \frac{Q_{it}}{p_{j(i)t}} = \left(\frac{1}{p_{j(i)t}} \right) \left(\frac{v_{it}}{L_{it}} \right) \tag{25}$$

and profits defined as

$$\pi_{it} = \frac{v_{it} - w_{it} L_{it}}{Y_{it}}. \tag{26}$$

Descriptive statistics are shown in Table 1.

Table 1
Descriptive statistics, Moroccan firms in manufacturing census

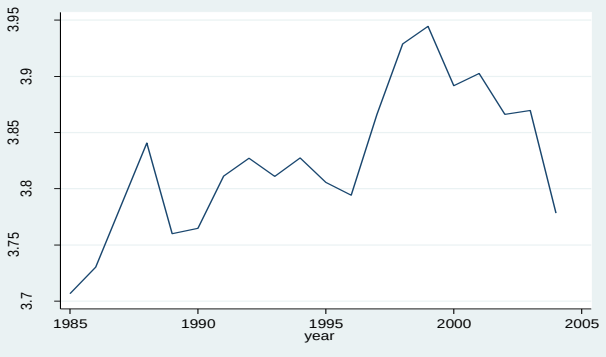
	Mean	Std. Dev.
Number of employees	67.40	188.68
Labor productivity a/	3.84	0.99
Operating profits (ratio)	0.10	1.86
Age	15.99	14.00
Export Share	0.18	0.36

Note:
a/ Log of value added per worker.

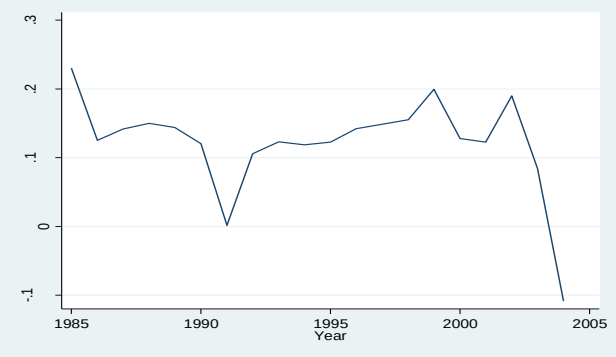
Figure 3 shows that the growth of real labor productivity has been almost nil over the sample period (one tenth of one percent per year on average) a picture that is consistent with macro data. Profits have been roughly stable, between 10 and 20 percent, over the sample period, except for two dips, one in 1991 and one in 2004.

Figure 3
Average labor productivity and profit, 1985-2005

(a) Real labor productivity



(b) Operating profits



Source: Authors calculations from Moroccan industrial survey.

NTM data comes from a new database built as part of a joint effort of the World Bank, UNCTAD, and the African Development Bank (see Cadot and Malouche 2012 for details).[8] For Morocco and other Middle East and North African countries, the data was collected in collaboration with the FEMISE institute. In its raw form, the data consists of national inventories of all trade-relevant regulations, including product standards, sanitary and phytosanitary (SPS) regulations, quantitative restrictions, import prohibitions, customs regulations including pre-shipment inspection when applicable, and so on, together with the products to which the regulations apply, using the Harmonized System's 6-digit nomenclature.

Each inventory includes the date at which the relevant regulatory text was adopted and the originating/enforcement agency. In Morocco's case, the regulatory texts in question were either laws or decrees; in many cases, a single decree could cover several products and several "measures" in the sense of the MAST classification (e.g. a labeling requirement and a maximum residual level of pesticides in a food product). Next, the data was coded in binary form in a matrix with HS6 products in rows and NTM codes in columns. The codes used the 2009 MAST nomenclature, which includes, in its most detailed form, 121 categories of measures.[9] Thus, in the final data matrix, a cell is made of a (product × measure) pair; a measure that applies to several products (as most do) is counted as many times as there are affected products.

In the case of Morocco, the data also includes whether a measure was harmonized with E.U. standards or not. It indicates the year of adoption of each measure in force as of 2010, but it does not indicate what was in place before.[10] Thus, in principle, the regulatory change recorded at the entry into force of a new regulation could be either a relaxation, a stiffening, or a neutral change in regulation. For instance, a maximum residual level of pesticides in vegetables adopted in year t could be higher, lower or identical to the previous one. However, when measures were coded as harmonization with E.U. regulations, one can safely presume that the new measures were stiffer than the ones they replaced, especially in foodstuffs, as the E.U. typically had more stringent product and sanitary standards than middle-income countries. In addition, harmonization was often accompanied by technical assistance on enforcement, implying that even in cases where regulatory texts looked similar to older ones, they were likely to bite more. Thus, one can safely assume that harmonized measures implied adaptation strategies by the private sector, which makes them interesting policy changes to study.

In most countries, and in particular in Morocco, the inventory was drawn up in close collaboration with government authorities and was followed by a "validation workshop" where relevant government agencies (trade, health, agriculture ministries, sanitary authorities, standards bureaus, and so on) had the opportunity to comment on the accuracy and completeness of the inventory.

In what follows, a "measure" is a pair of HS6 and MAST codes (say, HS010110, A110). We summed the number of new and harmonized measures over all HS6 products within ISIC-4 sectors in order to make them compatible with Morocco's industrial-survey categories. Table 2 shows a count of

[8] After consistency checks by UNCTAD specialists, the data is published as part of UNCTAD's TRAINS database, publicly accessible through the World Bank's WITS portal.

[9] The 2009 MAST nomenclature was updated in 2012 for use in the WTO's NTM notification system. Thus, starting in 2012, new NTM notifications by WTO members and data collected to replenish UNCTAD's TRAINS database for researchers will use the same nomenclature, improving complementarity between the two sources as well as the scope for cross-checks.

[10] There is data on NTMs in the 2001 TRAINS database but it is not as precise as the new wave, making comparison difficult.

harmonized measures (HS6 × MAST) by sector over the sample period (for readability, the table is aggregated to ISIC-2 sectors, wider than ISIC-4, and limited to those sectors with nonzero harmonization numbers). Food & beverages is the most affected, with 57.8% of the total number of harmonizations, followed by chemicals (31.4%), reflecting tight E.U. standards in these sensitive sectors and pressures on the E.U.'s preferential trade partners to adopt similar ones.

Table 2
Number of harmonizations by 2-digit sector

	Food	Textile	Chem.	Plastics	Mach.	Furnit.
1985	0	0	0	0	0	0
1986	0	0	0	0	0	0
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	0	0	0	0	0	0
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	65	0	0	5	0	0
1994	10	0	0	5	0	0
1995	7	0	0	0	0	0
1996	125	0	0	0	0	0
1997	0	0	16	0	0	0
1998	0	0	0	0	0	0
1999	0	0	0	0	12	0
2000	173	0	0	0	0	0
2001	0	0	0	0	0	0
2002	0	1	0	0	15	14
2003	31	0	141	0	0	1
2004	0	0	0	1	0	0

Note: Data aggregated from ISIC 4 to ISIC 2 digit.
Source: Multilateral NTM database

Figure 4 shows that harmonization took place in waves, with the biggest batches taking place in 1993 (70 harmonized measures adopted), 2000 (173) and 2003 (173).

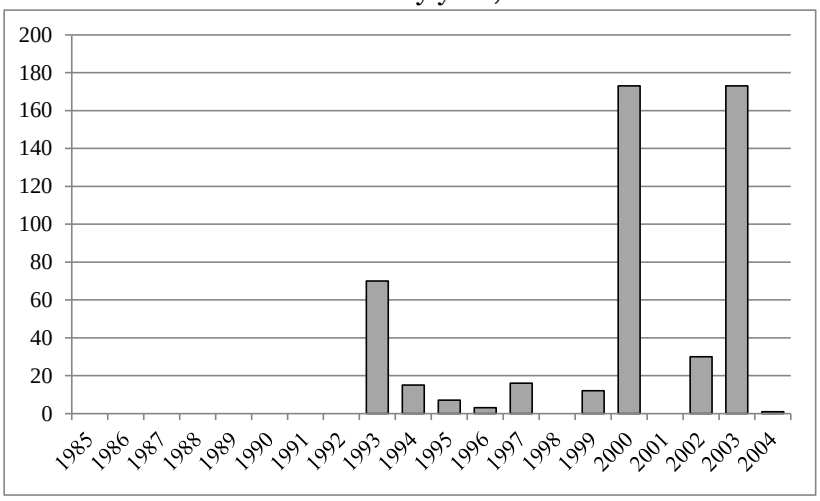
Do harmonization waves make a difference to profits and labor productivity? As a first pass at the data, in Figure 5 we rescale time, for each 4-digit sector, to be zero at the time of the first large wave of harmonization, and then take the cross-firm average of profits and labor productivity within each of these constructed time periods. That is, let j be a sector, $t(j)$ the year of the first harmonization wave in that sector (the "harmonization year"), and $n_{j,t(j)}$ the number of firms in sector j in the harmonization year, then the average profit displayed in the figure is constructed as

$$\bar{\pi}_\ell = \frac{1}{\sum_j n_{j,t(j)+\ell}} \sum_j \sum_{i \in j} \pi_{i,t(j)+\ell}, \quad \ell = -10,...,0,...,10.$$

and similarly for labor productivity. Figure 5 suggests a positive effect of harmonization on profits (panel a) and on labor productivity (panel b), although possibly with strong anticipation effects.

However, these prima-facie average differences cannot be interpreted directly as they do not control for firm heterogeneity and are thus vulnerable to many confounding influences.

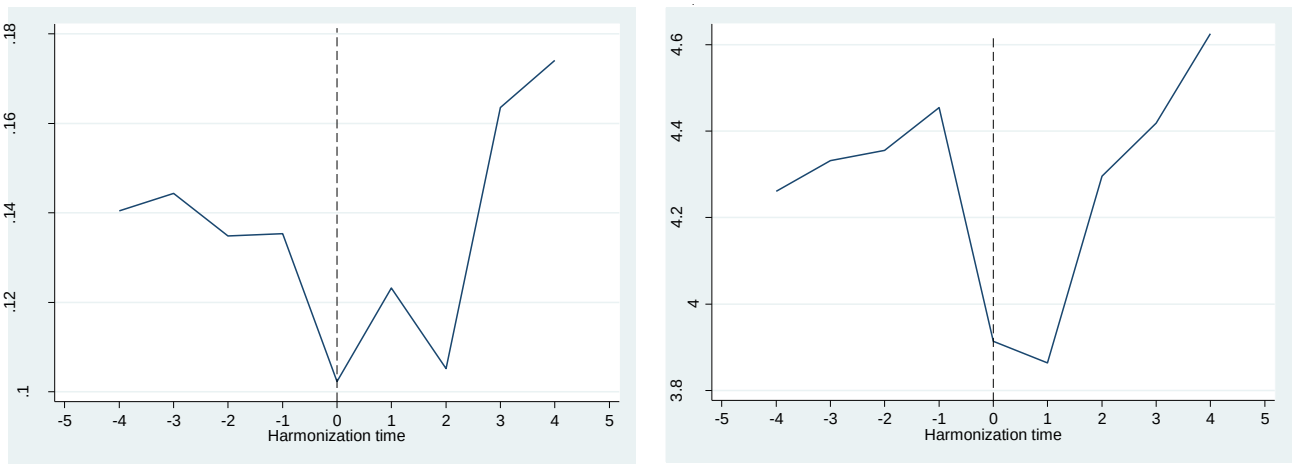
Figure 4
Harmonizations by year, all sectors



Source: Authors' compilation using multilateral NTM database

Figure 5
Profit and productivity path, before and after harmonization

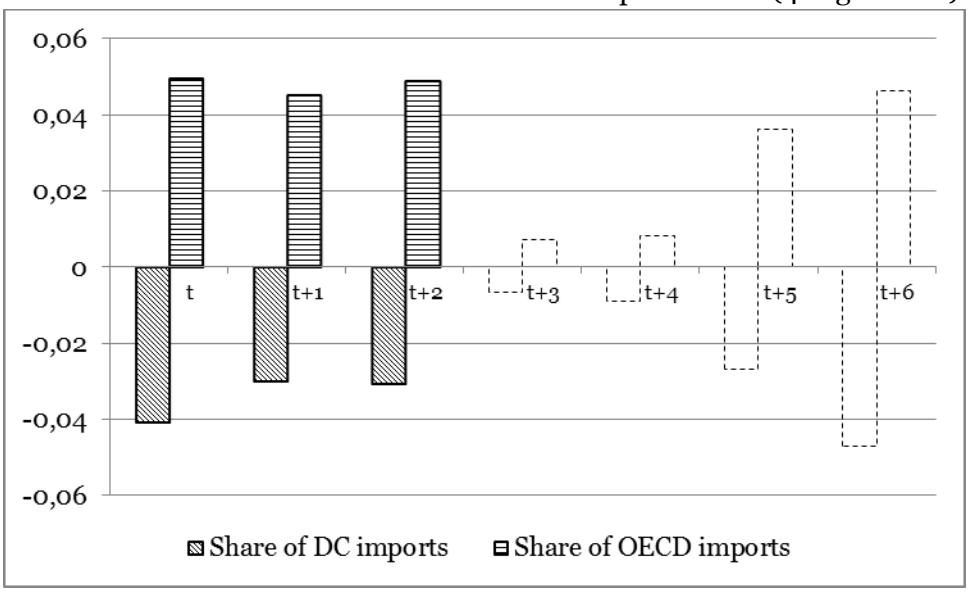
(a) Profits (b) Real labor productivity



Note: Time is rescaled to be zero, by sector, in the first year where a harmonization wave takes place.

Do harmonization waves impact competitive pressure on the domestic market? The model in Section 2 suggests that harmonization should alter competition on the domestic market, by limiting competition from low-income producers and raising that from high-income producers. As a first pass at the data, we regress the impact of harmonization on the shares of developing and high-income countries respectively, at the 4-digit level. We control for time and sectoral effects. Parameters estimates are shown in bar charts in Figure 6 and are in line with expectations: The share of developing countries in total imports goes down while that of high-income countries goes up after harmonization.

Figure 6
The effect of harmonizations on sector-level import shares (4-digits level)



Note: Insignificant estimates shown as blank columns with dotted lines.

We now turn to a systematic exploration of the effect of sector-level harmonization waves on firm profits and productivity, controlling for observed and unobserved heterogeneity between firms.

3.2 Estimation issues

Let *i* index firms, *j* ISIC 4-digit sectors, *k* ISIC 2-digit sectors (wider than *j*), *t* years, and *j*(*i*) firm *i*'s sector at the 4-digit level. Let $n_{j(i),t-1}$ be the cumulated number of harmonized measures in firm *i*'s 4-digit sector up to year *t*-1 (a year before the outcome is measured in order to allow for end-of-year measures). Let also $\tau_{j(i),t-1}$ be the average tariff applied to imports in firm *i*'s sector in year *t-1*, y_{it} the outcome variable for firm *i* in year *t* (either the log of labor productivity or the markup ratio, depending on the equation), and $\mathbf{x}_{it}$ a vector of time-variant firm characteristics including age and lagged export share. Our baseline estimation equation is

$$y_{it} = \alpha_0 + \alpha_1 n_{j(i),t-1} + \gamma \tau_{j(i)t} + \mathbf{x}_{it}^{'}\boldsymbol{\beta} + \delta_i + \delta_t + u_{it} \qquad (27)$$

where δ_t and δ_t are respectively firm and time effects. In some specifications, we replace firm effects with sector effects.

Equation (27) is basically a treatment-effects equation in which the treatment is applied at the sector level and is of variable intensity. Estimating the treatment's effect raises the usual identification issues, including endogeneity and unobserved heterogeneity in levels and growth.

As for endogeneity, harmonization was largely dictated by the European Commission, limiting the potential for reverse causation through political-economy channels. Essentially, one could be worried that in bargaining over the sequencing of harmonization with its E.U. counterpart, the Moroccan government might have opted for faster harmonization in sectors when it would shelter Moroccan producers from Chinese or other low-cost competition, while negotiating delays in sectors where E.U. competition would be a threat. If such had been the case, clearly the apparel sector would have been a prime target for harmonization (e.g. concerning the synthetic components of fabrics which are regulated in the E.U. for potentially harmful chemicals), as it is a major employer in Morocco and under intense pressure from low-cost competition. But there was very little harmonization in textiles (Table 2) and none at all in apparel. Conversely, the food & beverages and chemical sectors are sensitive ones in the E.U. (all chemicals are covered by the wide-ranging REACH set of regulations) and they are the ones most heavily covered by harmonized measures in our data. Similarly, the plastics sector has been affected by harmonization although E.U. plastics regulations are relatively easy to comply with for Chinese producers, as the Chinese government has been progressively adopting domestic regulations converging on a combination of E.U. and U.S. standards.[11]

As for unobserved heterogeneity in firm-level profits and productivity, we use firm fixed effects to control for time-invariant omitted variables as well as firm-level control variables available from Morroco's industrial survey. We also control for macroeconomic variables with time effects. As for unobserved heterogeneity in trend growth rates of profits and productivity, Figure 7 plots the time path of profits and productivity (in levels) averaged over firms within two groups: (i) firms in sectors concerned by harmonization waves (the treatment group, shown with a plain line) and (ii)

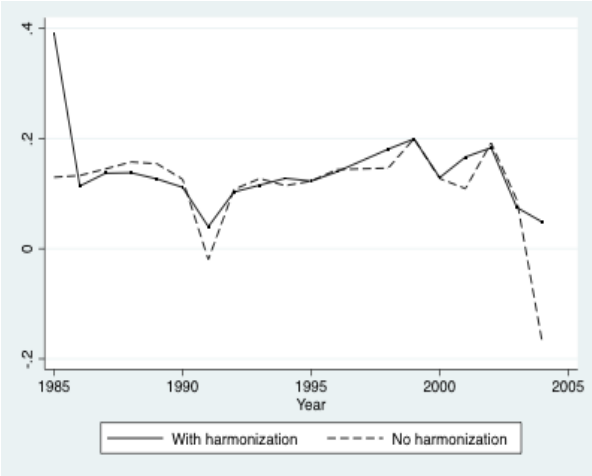
[11] We are grateful to Alistair Irvine, Manager, Food Contact Compliance, Smithers Pira, for useful clarifications on this point.

firms in other sectors (the control group, shown with a dashed line). Note that the time variable on the horizontal axis is now real time, not "analytical" time as in Figure 5.

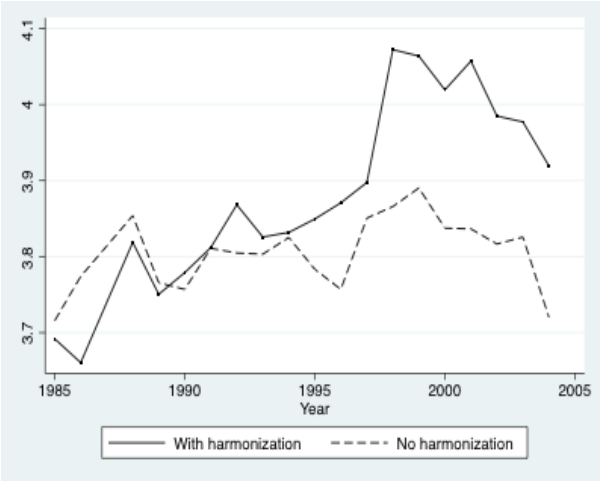
In the case of profits (panel a), the trends are clearly parallel except for the samples initial and terminal years (excluding those does not affect our results). In the case of productivity, they are also roughly parallel except between 1997 and 1998 where firms in sectors affected by harmonization recorded a large jump, although few harmonizations took place (Table 2). We look further into the parallel-trends issue in Section 3 where we run a "placebo" treatment over random years prior to the real treatment (harmonization) years.

Figure 7
Time path of profits and productivity,

(a) Profits



(b) Real labor productivity



Finally, as is standard (see Bertrand, Duflo and Mulainathan 2004) we cluster standard errors at the firm level in order to allow for any pattern of serial correlation in the error term.4. Results

4.1 Baseline

Table 3 reports OLS (within-firm) estimates of the effect of the count of sector-level harmonizations on profits and real labor productivity.

Profits and labor productivity correlate strongly with harmonization counts in the within-firm specifications (columns 1 and 3). In markup equations, the count of harmonizations is significant at 1% with a point estimate around 0.31-0.35; the marginal effect of a harmonized NTM is an increase in the average markup rate between 31 and 35%, a very large effect. In labor-productivity equations, the count of harmonizations is statistically significant at 1% in the within-firm specification (column 3), with a marginal effect of 23% at the mean.

Profits and labor productivity correlate respectively negatively and positively with firm age, although there is no prior on these relationships. Only productivity correlates robustly with the

share of exports in turnover.[12] Sector tariffs raise both profits and productivity in the firm-FE specifications (columns 1 and 3) although not in the sector-FE ones (columns 2 and 4). The effect on profits is intuitive, while the effect on productivity may run against the conventional wisdom that protected sectors tend to be inefficient. However, our dependent variable here is labor productivity, not TFP, and it can be the result of capital deepening rather than enhanced efficiency. Protection can be expected to raise the return to both labor and capital, and with a non-homothetic technology may (or may not) lead to capital deepening, so not too much should be made of this correlation.

Table 3
Baseline regression results, profits and productivity

Dep. Var.	Operating profits		Real labor productivity	
Estimator: OLS	(1)	(2)	(3)	(4)
Harmonizations a/	0.3506***	0.3151***	0.2321***	0.1220
	(0.0756)	(0.0422)	(0.0877)	(0.0905)
Tariff a/	0.1556**	0.0806	0.1308*	0.0090
	(0.0708)	(0.0515)	(0.0747)	(0.0759)
Age	-0.0190***	-0.0008**	0.0113***	0.0078***
	(0.0036)	(0.0004)	(0.0026)	(0.0007)
Export share a/	0.0279	0.0204*	0.1482***	0.2459***
	(0.0328)	(0.0115)	(0.0385)	(0.0294)
Constant	0.2491***	-0.1338***	3.4913***	3.5905***
	(0.0740)	(0.0431)	(0.0881)	(0.0399)
Fixed effects				
Firm	Yes	No	Yes	No
Sector	No	Yes	No	Yes
Year	Yes	Yes	Yes	Yes
Observations	35'187	35'187	35'187	35'187
R-squared	0.344	0.025	0.748	0.279

Note: Robust standard errors, clustered at firm level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.
a/ Lagged one year

In sum, so far the evidence suggests that the harmonization of Moroccan regulations on E.U. standards led to higher profits and labor productivity. The latter effect may be channeled either through improved efficiency or through capital deepening, as compliance with stiffer standards

[12] Theory predicts that exporters are larger and more productive than domestic sellers. Among exporters, the largest and most productive tend to have a wider spectrum of exported products (Chatterjee, Dix-Carneiro and Vychianon, 2012), so the share of exports in turnover can be expected to correlate with size. This may or may not imply a correlation with markups. With CES demand and no distribution costs, markups are independent of size (Melitz 2002); with additive distribution costs (Berman, Martin and Mayer 2012) or quasi-linear demand (Ottaviano and Melitz 2008), markups correlate positively with size.

may have implied the acquisition of new machinery. Our data does not allow us to observe directly any additional cost, but profits rose.

4.2 Did harmonization protect Morocco's home market?

As Morocco's technical regulations are harmonized with stiffer E.U. standards, two effects can be expected on the domestic market. On the one hand, the cost of accessing the Moroccan market should rise for low-quality (non-complying) producers from developing countries. Depending on the elasticity of substitution between low- and high-quality varieties, this should allow Moroccan firms to raise prices and therefore profits. On the other hand, the improved profitability of the Moroccan market should induce the entry of E.U. producers who were kept out by competition from low-end suppliers.

We try to identify these effects by separating sectors between those with a high initial share of imports from developing countries vs. those with a high share of imports from OECD countries. For this, we define a time-invariant dummy variable marking sectors with a high initial share of imports from developing countries[13], this share proxying for sectors in which developing countries have a comparative advantage and where the competitive pressure from them is strongest:

$$\delta_{j(i)}^{DC} = \begin{cases} 1 & \text{if } \mu_{j(i)}^{DC} \equiv M_{j(i),t_0}^{DC} / M_{j(i),t_0} \geq \lambda \\ 0 & \text{otherwise} \end{cases} \tag{28}$$

where $M_{j(i),t_o}^{DC}$ is the value of imports from developing countries in firm *i*'s sector[14] in the sample period's initial year t_0 and $M_{j(i),t_o}$ is the sector's total import value. We set λ at the 75th percentile of the cross-sectoral distribution of $\mu_{j(i)}^{DC}$.[15] Similarly,

$$\delta_{j(i)}^{OECD} = \begin{cases} 1 & \text{if } \mu_{j(i)}^{OECD} \equiv M_{j(i),t_o}^{OECD} / M_{j(i),t_o} \geq \lambda \\ 0 & \text{otherwise} \end{cases} \tag{29}$$

marks sectors with a high initial share of imports from OECD countries, i.e. where industrial countries have a comparative advantage. The new estimating equation is now

$$\ln(y_{it}) = \alpha_0 + \alpha_1 n_{j(i),t-1} + \alpha_2 \left(n_{j(i),t-1} \times \delta_{j(i)}^{DC} \right) + \gamma \tau_{j(i)t} + \mathbf{x}_{it}' \boldsymbol{\beta} + \delta_i + \delta_t + u_{it} \tag{30}$$

and similarly when using $\delta_{j(i)}^{OECD}$. We expect harmonization to raise profits when $\delta_{j(i)}^{DC} = 1$ (market-protection effect) and to reduce it when $\delta_{j(i)}^{OECD} = 1$ (entry effect).

The results reported in Table 4 suggest both market-protection (trade-diversion) and entry (trade-creation) effects on profits (columns 1 and 2). Profits are significantly lower in sectors where

[13] Information about the origin of imports is available only since 1993 on Comtrade. Thus, what we call "inital year" is 1993, which is not a problem as the first harmonization started that year.

[14] Developing countries are defined here as all but high-income (OECD and non-OECD) using the World Bank's classification.

[15] We also set λ at the median in a different specification, with qualitatively similar although weaker results.

competition from developing countries is most intense, as expected. Most interestingly, interaction terms are positive in those sectors and negative in sectors with high OECD import penetration, being significant (1%) in both cases. Thus, harmonization seems, as predicted, to have changed the terms of competition by sheltering Moroccan producers from low-cost competition while exposing them to industrial-country competition. Effects on labor productivity are insignificant, and indeed there is no strong a-priori on the sign of those.

Table 4
Protection and entry effects

Dependent variable	Operating profits		Real labor productivity	
Estimator: OLS	(1)	(2)	(3)	(4)
Harmonization b/	0.2498***	0.4171***	0.1969**	0.2075*
	(0.0600)	(0.0911)	(0.0990)	(0.1096)
Harmonization interacted with				
High initial share of DC imports a/	0.2619***		0.0915	
	(0.0823)		(0.1805)	
High initial share of OECD imports a/		-0.1997***		0.0740
		(0.0758)		(0.1775)
Tariff b/	0.1618**	0.1600**	0.1329*	0.1291*
	(0.0714)	(0.0714)	(0.0747)	(0.0748)
Age	-0.0190***	-0.0190***	0.0113***	0.0113***
	(0.0036)	(0.0036)	(0.0026)	(0.0026)
Export share b/	0.0277	0.0276	0.1481***	0.1483***
	(0.0328)	(0.0328)	(0.0385)	(0.0385)
Constant	0.2438***	0.2449***	3.4894***	3.4928***
	(0.0739)	(0.0741)	(0.0881)	(0.0882)
Fixed effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Marginal effects c/	0.5117***	0.2174***	0.2884*	0.2815**
	(0.1096)	(0.0605)	(0.1548)	(0.1428)
Observations	35'187	35'187	35'187	35'187
R-squared	0.344	0.344	0.748	0.748

Notes
a/ With initial share above 75th percentile
b/ Lagged one year
c/ Estimated as $\hat{\alpha}_1 + \hat{\alpha}_2$ with bootstrapped standard errors.

The dynamics of our trade-diversion and trade-creation effects is shown in Table 5, where each line corresponds to a different regression and only the marginal effect of the harmonization count is shown. Column 1 is estimated over all sectors and column 2 on high DC-penetration sectors only. Effects in both cases persist for four years, after which they become insignificant, suggesting that following the change in the competitive pressure it takes about four years for the market structure

to fully adjust to the new regulatory environment. Thereafter, the market-sheltering effect of harmonized regulations does not seem to work anymore. Effects on labor productivity vanish after two years.

Table 5
Lagged effects

	Operating profits		Real labor productivity	
Harmonization lag	All sectors a/	High DC penetration b/	All sectors a/	High DC penetration b/
	(1)	(2)	(3)	(4)
t	0.2742***	0.3739***	0.1939**	0.1889
	(0.0583)	(0.0782)	(0.0852)	(0.1270)
t-1 c/	0.3506***	0.5117***	0.2321***	0.2884*
	(0.0756)	(0.1097)	(0.0877)	(0.1548)
t-2	0.1324***	0.2933***	0.1057	0.2017
	(0.0424)	(0.1140)	(0.1371)	(0.4529)
t-3	0.1511***	0.3336***	0.1332	0.2568
	(0.0496)	(0.1080)	(0.1362)	(0.5026)
t-4	0.1975**	0.4161***	0.0569	0.0151
	(0.0778)	(0.1467)	(0.1355)	(0.4800)

a/ Direct effect
b/ Marginal effect including interaction term (high share of DC imports)
c/ Coefficient in column (1) corresponds to coeff. in column (1) of Table 3; coeff. in col. (2) corresponds to marginal effect in col. (1) of Table 4.

4.3 Firm characteristics

As already discussed, harmonization affected essentially Morocco's domestic market—exporters to the E.U. already had to comply with E.U. regulations—so its effect on exporters vs. non-exporters are ambiguous. If the "trade diversion" effect of harmonization dominates (the first case in Section 2), then z_{12}^{*} goes up and some domestic firms exit exporting, raising the average productivity of remaining exporters through selection.[16] If the "trade creation" effect dominates, the opposite pattern holds.

With learning effects, i.e. in a setting where a package of harmonization-cum-technical assistance helps boundedly rational domestic producers to upgrade productivity, one would expect to see less effect for better-informed firms or those with access to best-practice management skills, i.e foreign-owned firms and large ones. Also, under an economy-wide credit constraint, one would expect that adaptation to higher standards would be easier for firms that rely more on self-financing than for firms that rely on bank finance.

Table 6
Harmonization effects and firm characteristics

[16] Our data does not allow us to study entry and exit rate as it is not properly speaking a census ; it is merely a large survey, so entry into and exit from the dataset do not necessarily mean real firm entry and exit.

Dependent variable	Operating profits				Real labor productivity			
Estimator: OLS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Harmonization a/	0.3059***	0.3759***	0.4120***	0.5114***	0.1982*	0.2792**	0.2883*	0.3975**
	(0.0819)	(0.0860)	(0.1079)	(0.1392)	(0.1149)	(0.1088)	(0.1598)	(0.1916)
Harmonization interacted with								
Exporter b/	0.0829				0.0629			
	(0.0756)				(0.1674)			
Foreign-owned b/		-0.0492				-0.1534		
		(0.0775)				(0.1801)		
Old b/			-0.0834				-0.0762	
			(0.0881)				(0.1868)	
Large b/				-0.2073*				-0.2133
				(0.1150)				(0.2093)
Tariff a/	0.1572**	0.1633**	0.1564**	0.1554**	0.1320*	0.1298	0.1315*	0.1306*
	(0.0711)	(0.0829)	(0.0709)	(0.0707)	(0.0749)	(0.0857)	(0.0747)	(0.0747)
Age	-0.0190***	-0.0189***	-0.0190***	-0.0191***	0.0113***	0.0125***	0.0113***	0.0112***
	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0026)	(0.0028)	(0.0026)	(0.0026)
Export share a/	0.0276	0.0472	0.0279	0.0283	0.1480***	0.1594***	0.1482***	0.1487***
	(0.0328)	(0.0339)	(0.0328)	(0.0328)	(0.0384)	(0.0441)	(0.0385)	(0.0385)
Constant	0.2474***	0.2380***	0.2478***	0.2494***	3.4900***	3.5122***	3.4901***	3.4916***
	(0.0742)	(0.0816)	(0.0740)	(0.0740)	(0.0884)	(0.0999)	(0.0881)	(0.0881)
Fixed effects								
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marginal effect c/	0.3887***	0.3267***	0.3287***	0.3041***	0.2610**	0.1258	0.2121***	0.1842*
	(0.0854)	(0.0861)	(0.0747)	(0.0686)	(0.1255)	(0.1465)	(0.1020)	(0.0936)
Observations	35.187	27.46	35.187	35.187	35.187	27.46	35.187	35.187
R-squared	0.344	0.344	0.344	0.344	0.748	0.747	0.748	0.748

Notes:
a/ Lagged one period
b/ Dummy variable
c/ With interacted term = 1

Results are shown in Table 6. It is striking that almost none of them is significant, and their inclusion does not alter the range of point estimates of the coefficient on harmonizations in markup or productivity equations. While absence of evidence is not evidence of absence, exporters do not seem to have benefitted from harmonizations more than non-exporters. Plausible conjectures on the lower effect of harmonizations for foreign-owned or large firms do not seem to be borne out by the data.

4.4 Robustness and extensions

In this section we consider a few extensions and robustness exercises. First, we include the number of new, domestic (non-harmonized) NTMs as a control variable to check if what did the trick was not the mere modernization of regulations instead of their harmonization. Our data does not allow us to assess whether new NTMs were stiffer or looser than those they replaced; so all we can test is

for a "modernization" effect that would be independent of whether NTMs were internationally harmonized or not.

Table 7
Controlling for non-harmonized NTMs

Dependent variable	Operating profits		Labor productivity	
	(1)	(2)	(3)	(4)
Harmonization a/	0.2153***	0.1709***	0.2390***	0.0092
	(0.0536)	(0.0361)	(0.0914)	(0.0984)
Tariff a/	0.1380*	0.0655	0.1317*	-0.0027
	(0.0708)	(0.0523)	(0.0753)	(0.0767)
Age	-0.0213***	-0.0008**	0.0114***	0.0078***
	(0.0042)	(0.0004)	(0.0027)	(0.0007)
Export share a/	0.0279	0.0211*	0.1482***	0.2465***
	(0.0328)	(0.0115)	(0.0385)	(0.0294)
Domestic NTM a/ b/	0.1033**	0.0946***	-0.0053	0.0739*
	(0.0439)	(0.0287)	(0.0351)	(0.0391)
Constant	0.2824***	-0.1553***	3.4896***	3.5737***
	(0.0795)	(0.0452)	(0.0895)	(0.0405)
Fixed effects				
Firm	Yes	No	Yes	No
Sector	No	Yes	No	Yes
Year	Yes	Yes	Yes	Yes
Observations	35.187	35.187	35.187	35.187
R-squared	0.345	0.025	0.748	0.279

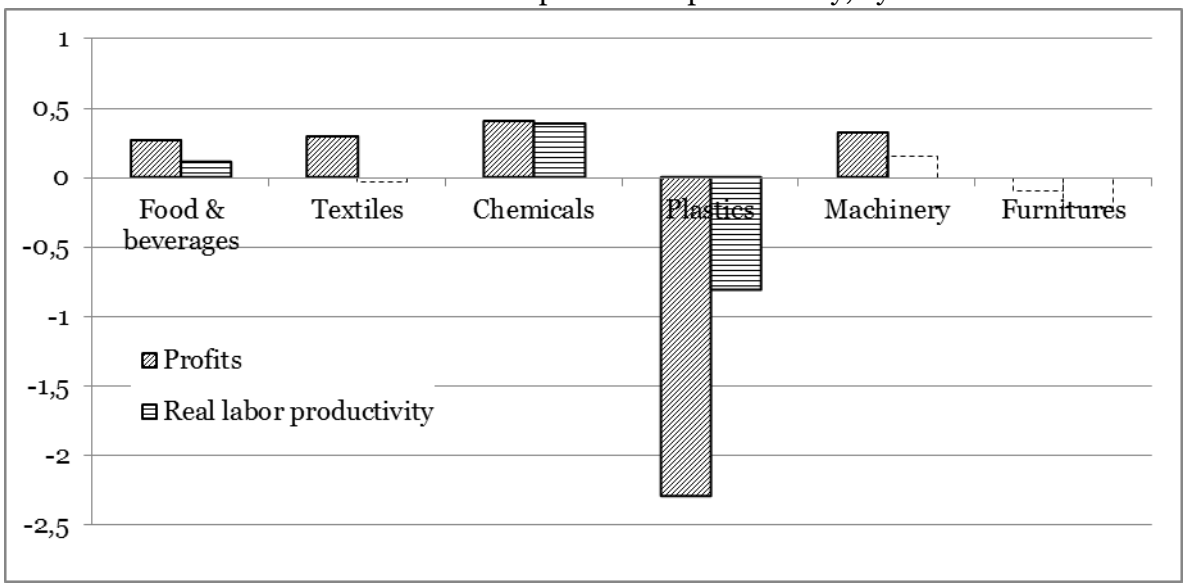
Notes
a/ Lagged one period
b/ Count of domestic (non-harmonized) NTMs by sector

Results are shown in Table 7. Interestingly, whereas inference is not affected (the levels of significance remain the same), the point estimates go down substantially in the case of profits. As initial estimates without inclusion of non-harmonized NTMs were on the high side, this is good news. However, given that new, non-harmonized NTMs have positive and significant coefficients and that the sum of the two (on harmonized and non-harmonized NTMs) adds up to about the same overall effect, it still implies a very strong effect of regulatory modernization on firm profits. As for productivity, non-harmonized NTMs do not seem to have any significant effect, and their inclusion leaves the coefficient on harmonized ones in the same range as before. Thus, domestic, non-harmonized NTMs seem to have contributed to boost profits without affecting labor productivity, suggesting again a protection effect.

Decomposing effects by broad (2-digit) sector, i.e. allowing coefficients to vary across sectors through the interaction of harmonization with sector dummies, profitability effects appear similar on food & beverages, textiles, chemicals, and machinery, while productivity effects are unstable (parameter estimates are shown in bar charts in Figure 8). Note that these are "per-harmonized NTM" effects as the number of harmonizations varies strongly between sectors. The plastics sector

stands out with negative effects on both profits and labor productivity. E.U. regulations on plastics for food containers seem, according to an industry specialist contacted by the authors, to be more complex than U.S. FDA regulations but relatively easily to catch up with by Chinese competitors whose own domestic regulations are apparently converging toward a mixture of U.S. and E.U. regulations. If China is progressively adopting standards that are broadly compatible with E.U. and U.S. ones, harmonization may not be effective as a protection device while nevertheless involving high compliance costs. [17]

Figure 8
The effect of harmonizations on profits and productivity, by broad sector



Note: Insignificant estimates shown as blank columns with dotted lines.

As a robustness exercise, we now convert our harmonization count into a binary treatment variable and re-run our baseline specification. Results are shown in Table 8. Results are qualitatively similar but the markup effect is substantially smaller: A wave of harmonization at the sector level, ceteris paribus, raises the markup rate by 16.86% and labor productivity by 7.5% ($e^{0.0719}$-1), a plausible range.

[17] Mangelsdorf, Portugal-Perez and Wilson (2012) have shown how the adoption of international standards by Chinese authorities seem to correlate with better export performance at the sector level.

Table 8
Baseline results with binary harmonization variable

Dependent variable Estimator: OLS	Operating profits (1)	Real labor productivity (2)
Harmonization a/ b/	0.1686***	0.0719**
	(0.0409)	(0.0290)
Tariff a/	0.0935	0.1117
	(0.0686)	(0.0751)
Age	-0.0234***	0.0099***
	(0.0046)	(0.0028)
Export share a/	0.0318	0.1500***
	(0.0328)	(0.0385)
Constant	0.3491***	3.5230***
	(0.0861)	(0.0903)
Fixed effects		
Firm	Yes	Yes
Year	Yes	Yes
Observations	35.187	35.187
R-squared	0.345	0.748

Notes
a/ Lagged one period
b/ Dummy variable, = 1 if count > 0

In order to verify that our central result was not spurious, we ran a standard placebo exercise consisting of generating random times for sector-level harmonization waves and running our binary specification 1'000 times on these random times, each time retrieving the point estimate and its standard error. Average values are shown in Table 9. Both for profits and productivity, the average *t* value calculated as the ratio of the average point estimate to the average standard error is substantially below the critical level and insignificant at any level.

Table 9
Placebo exercise results

Dependant variable	Mean parameter estimate	Mean standard error	Mean t-value	Replication number
Operating profits	0.1468	0.2849	0.5153	1 000
Labor productivity	-0.0432	0.0651	-0.6636	1 000

5. Concluding remarks

Combining a tractable heterogeneous-firms model with census data in the context of a massive harmonization effort in Morocco allowed us to highlight some of the effects of harmonization in a way that had not been done in the literature so far, with potentially important policy implications.

Theoretically, following Demidova and Rodriguez-Clare's treatment of the Melitz model (Demidova and Rodriguez-Clare 2011), we showed that harmonization involved a combination of trade-creation and trade-diversion effects playing out through induced changes in relative vs. international trade costs. In words, the trade-creation effect plays out vis-à-vis the preferential partner (with whom harmonization takes place) and reflects a reduction in *relative* trade costs (international vs. domestic). The trade-diversion effect play out vis-à-vis non-preferential trading partners and reflects a rise in relative trade costs.

In the case of Morocco, both effects are present, but the second dominates. We show this empirically by correlating changes in operating profits at the firm level with harmonization waves at the sector level. The model shows that the first effect (trade creation) pulls operating profits down (besides the usual selection effects) while the second pulls them up. We find that, on average, the operating profits of Moroccan firms went up after harmonization waves compared to a control group of firms in sectors that underwent no harmonization. We also find that the effect is much stronger in sectors with high penetration of non-E.U. imports, suggesting that harmonization on E.U. standards "shuts the door on the low-cost producers" in accordance with the model's prediction. This effect, however, seems to be temporary, vanishing—presumably because out of region exporters adapt to the new standards—after about four years.

The political-economy implications of the analysis are important. Disdier et al. (2012) showed using a gravity approach that, for developing countries, harmonization on stiff Northern standards hampered South-South integration and reinforced hub-and-spoke trade patterns. Their argument was that compliance raised the costs of the Southern partner's exporters, pricing them out of other Southern markets. Here, we show with firm-level data why this may be a "Faustian bargain" for the Southern-partner government: while forsaking possible potential gains in South-South trade, it gains support from domestic import-competing constituencies fearing Southern, low-cost competition. Our data suggests that, indeed, harmonization helps them preserving profit margins, at least temporarily until Southern producers adapt. This may be an important political-economy argument for other middle-income countries like e.g. Mexico or Tunisia whose labor costs are too high to compete head on with low-cost exports from Asia and for whom deep North-South regionalism can be a temporary shelter, allowing them to gain time.

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