UvA ECONOMETRICS

Discussion Paper: 2004/01
(revised May 2005)

Exports and productivity: Moroccan manufacturing 1985-1995

Maurice J.G. Bun and Abdel El Makhloufi

www.fee.uva.nl/ke/UvA-Econometrics

Department of Quantitative Economics
Faculty of Economics and Econometrics
Universiteit van Amsterdam
Roetersstraat 11
1018 WB AMSTERDAM
The Netherlands

UvA UNIVERSITEIT VAN AMSTERDAM

Exports and productivity:

Moroccan manufacturing 1985-1995

Maurice J.G. Bun* Abderrahman El Makhloufi†

(University of Amsterdam) (Utrecht University)

Keywords: exports, externalities, Morocco, panel data, productivity

Abstract

The relation between exports and productivity is analyzed for the case of Morocco using annual panel data for the years 1985-1995 covering 6 large urban areas and 18 manufacturing sectors. In the empirical analysis two main features are distinguished, i.e. productivity differentials and export externalities. The former is the most dominant one for Morocco, i.e. sectors with low labor productivity export most and within sectors exporting firms are more productive than nonexporting firms. Regarding the latter only weakly significant evidence is found of both sector wide or within sector productivity externalities as a result of exporting.

*Tinbergen Institute and Faculty of Economics and Econometrics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands (E-mail: m.j.g.bun@uva.nl)

†Utrecht School of Economics, Utrecht University, Vredenborch 138, 3511 BG Utrecht, The Netherlands (E-mail: a.elmakhloufi@econ.uu.nl)

INTRODUCTION

The relation between exports and economic development has been the subject of a large literature. Regarding developing countries it has been argued often that trade policy should adjust from import substitution to trade liberalization in order to boost exports and, hence, economic growth. In many empirical studies using cross-country data a positive correlation between aggregate output and exports has been established (for an overview, see e.g. Edwards, 1993).

This observed positive correlation between output and exports across countries has various theoretical explanations. First, it is often argued that exporting firms are more productive than nonexporting firms (Bernard and Jensen, 1999). Exporting firms have more efficient management and improved production techniques to face international competitive pressure. Second, it is often hypothesized that positive productivity externalities exist from exporting, both to exporting and nonexporting firms (Clerides et al., 1998). Exporting firms learn from foreign markets where their products are sold and benefit from the technical expertise of buyers. In addition, the increased knowledge of exporters, e.g. on how to organize production cheaply and efficiently, spills over to domestic firms. They benefit from the introduction of improved production techniques, higher qualified labor force, and so on.

Both explanations are motivated by a productivity comparison of exporting and nonexporting firms within a country and, hence, country specific empirical evidence on the nature of these productivity differentials is warranted. In this study we attempt to quantify the effects of exports on economic development in Morocco. The last few decades exports have been an important factor in Moroccan gross domestic product. After the debt crisis in 1983 this country has been submitted to a far reaching liberalization of its trade regime and an active exchange rate policy resulting in an substantial decrease in nominal and real exchange rates. As a result of this and the improved world economy, Moroccan GDP and exports grew at a relative fast rate in the late eighties. Regarding the nineties in a recent World Bank report (1999) on the economy of Morocco it is argued that "export growth, while slower than in the 1980s, will continue to play a leading role in growth and employment".

Using annual panel data on 18 manufacturing sectors for the years 1985-1995 we assess the relationship between exports and economic development by focusing on productivity differentials. In our empirical analysis we distinguish productivity differentials between and within manufacturing sectors. First, we identify export based sectoral productivity differentials by relating productivity to an indicator of sectoral export intensity. Following Nickell (1996) and İşcan (1998) we distinguish both productivity level and growth effects. The latter describes whether exporting sectors exhibit higher growth rates over time, while the former measures a combined time series cross-section correlation between export intensity and productivity levels. Second, we establish whether within sector productivity differentials exists between exporting and nonexporting firms. Following Feder (1982) we assume separate production functions for exporting and nonexporting firms where total sectoral exports enter the production function for nonexporting firms as an additional input factor.

Having established productivity differentials we next try to distinguish pure productivity differentials from productivity externalities. The identification of the latter is based on geographical proximity. We hypothesize that externalities as a result of exporting occur when innovations and improvements in one firm not only increases its own productivity, but also of similar firms in the same region. Hence, we consider local productivity externalities from exporting within the same industry and region. In our first empirical model we assess whether there are local sector-wide productivity growth externalities as a result of exporting. In our second empirical model we analyze local externalities from exporting to nonexporting firms. The particular geographical coverage of the data, i.e. the 6 largest urban areas in Morocco, may facilitate the estimation of potential externalities as they are maximized in large and densely populated areas with a high geographical concentration of economic activity.

In the next section a more detailed description of the data will be given. Next, we describe the various empirical models used to model the relationship between exports and productivity, discuss estimation and present estimation results. Finally, we discuss our empirical findings.

DATA AND DESCRIPTIVE STATISTICS

The available data contain annual time series of among other things gross value added, production, employment, investments and exports. The data set covers the period 1985-1995 and the data have been collected for 18 different manufacturing sectors and 6 large urban areas in Morocco, i.e. Casablanca, Rabat, Tangier, Fez, Meknes and Marrakech. Manufacturing accounts for about 20% of GDP in Morocco. The 6 urban areas contained in the data produce and employ around 70% of the whole manufacturing sector in Morocco.

The general economic situation in Morocco in the period 1985-1995 can be characterized as volatile. The late eighties show a period of substantial growth, while in the early nineties there is a slowdown in some years. This is partly due to the effects of drought on agricultural output, but also other sectors including manufacturing experienced a slowdown in economic development (Worldbank, 1999).

Regarding the manufacturing sector Table 1 shows for the 6 large urban areas contained in the data some year averages and average annual growth rates of some key variables (see the Appendix for more details), i.e. value added (Y), employment (L), capital stock (K), exports (X), labor productivity (P) and export intensity (S). The pattern of the year averages suggests a trending behavior in all variables. Average growth rates of value added, employment, capital stock and exports show a slowdown in economic performance in the early nineties. As employment falls larger then value added there is still a moderate increase in labor productivity, but export growth is virtually zero and export orientation slightly decreased.

The aggregated statistics of Table 1 hide a lot of variation across sectors. For example, unreported results show that average annual employment growth differs from a negative annual growth rate for basic metals (-0.9%) to a high record for clothing (+15.8). The rapid expansion of the latter sector is apparent also when analyzing shares in total manufacturing over time. The employment share of the clothing sector rose between 1985 and 1995 from 9.2% to 22.4%.

In Table 2 some additional stylized facts of the existing industrial structure have been given. More in particular, sectoral labor productivity (P) and export intensity (S) have been documented for the years 1985 and 1995. The majority of the sectors experienced an increase in labor productivity between 1985 and 1995. In Morocco the traditional sectors, i.e. textiles, clothing and leather and shoes, are the least labor productive sectors. Regarding export intensity the three traditional sectors mentioned above and chemical products are main exporting sectors in Morocco. In all but three sectors this ratio increased between 1985 and 1995 (notable exception is chemical products) showing the increased export orientation of Moroccan manufacturing firms. Summarizing, across sectors there is on average a negative correlation between labor productivity and export orientation, but over time these quantities seem to have a positive relation.

MODELS AND ESTIMATION

We develop two empirical models for estimating the relationship between output and exports. Both models are derived from standard production functions augmented with a component relating productivity to export performance. The first model focuses on between sector export based productivity differentials. It incorporates both productivity level and growth effects of exporting in addition to any (unobserved) industry and time specific heterogeneity. The second model specifies within sector productivity differentials between exporting and non-exporting firms. In both models we make an explicit distinction between pure productivity differentials and externalities. Finally, we conclude with a brief discussion on estimation.

Between sector productivity differentials – We assume that the production process can be approximated by a Cobb-Douglas production function, i.e. we specify for each cross-section unit i and time period t

$$Y_{it} = A_{it} L_{it}^{\beta_l} K_{it}^{\beta_k}, \qquad i = 1, ..., N; t = 1, ..., T, \tag{1}$$

where Y is output, L is labor, K is capital and A is the level of technology. The indices i

and t refer to specific sector-region units and years respectively. The parameters β_l and β_k are the elasticities with respect to labor and capital respectively. Taking logarithms on both sides of (1) we have

$$y_{it} = a_{it} + \beta_l l_{it} + \beta_k k_{it}, \tag{2}$$

where y, a, l and k are in logarithms. Regarding a_{it} we specify the following model

$$a_{it} = \alpha^* + \eta_i^* + \lambda_t^* + \varepsilon_{it}^* + \beta_{sl} s_{it}^l + \beta_{sg} s_{it}^g. \tag{3}$$

The elements in (3) represent a myriad of sources which may influence productivity levels. First, the region-sector specific effect η_i^* reflects heterogeneity in regional and/or sectoral technologies. Heterogeneity may exist because local resource endowments and the institutional, cultural and political environment may differ across sectors and regions. Second, the time specific effect λ_t^* measures aggregate productivity shocks at the national level. Third, the term ε_{it}^* represents any other idiosyncratic shocks to productivity levels. Finally, productivity differentials may be present as a result of export orientation. Using the indicator of export orientation (S) we approximate productivity differentials due to exports. Following Nickell (1996) and İşcan (1998) we model both a productivity level and growth effect by including the indicator itself ($s_{it}^l = S_{it}$) and the product of its time mean with a time trend ($s_{it}^g = S_{i.}t$ with $S_{i.} = \frac{1}{T}\sum_{t=1}^{T} S_{it}$) respectively. The growth effect describe whether export intensive sectors and regions exhibit higher growth rates in the sample period, while the level effect measure the combined time series cross-section correlation between export intensity and productivity levels. We interpret the former as productivity externalities, while we view the level effect as a combination of pure productivity differentials and externalities.

Combining (2) and (3) leads to

$$y_{it} = \beta' x_{it} + \alpha^* + \eta_i^* + \lambda_t^* + \varepsilon_{it}^*, \tag{4}$$

with $\beta = (\beta_l, \beta_k, \beta_{sl}, \beta_{sg})'$ and $x_{it} = (l_{it}, k_{it}, s_{it}^l, s_{it}^g)'$. We are primarily interested in getting plausible estimates for the parameter vector β in equation (4). This equation can be interpreted as determining equilibrium or long-run output levels in the absence of adjustment costs and/or lagged response. Examples of the former are transaction or search costs, while the latter may be due to, for example, lagged perception of environmental changes or habit formation (Hendry et al., 1984). Hence, actual output levels will depend on lagged outcomes. In applied time series econometrics the usual way of modelling such behavior empirically is to fit dynamic regression models to the data. More in particular, we specify the following Autoregressive Distributed Lag (ADL) representation, i.e.

$$y_{it} = \pi_0 y_{i,t-1} + \pi_1' x_{it} + \pi_2' x_{i,t-1} + \alpha + \eta_i + \lambda_t + \varepsilon_{it}, \tag{5}$$

The parameter vector of interest β can be estimated from the unrestricted ADL specification as $\frac{\pi_1' + \pi_2'}{1 - \pi_0}$. Dynamic production functions as in (5) have been used by various other authors, see for example Nickell (1996) or Blundell and Bond (2000).

Within sector productivity differentials – The model above only identifies between sector productivity differentials and sector wide externalities. Feder (1982) developed a model which takes into account within sector productivity differentials and externalities. His model is at the country level and estimated with aggregated cross-country data, but it can easily be adapted to the sector-region level within a particular country. Extending the production function framework from the previous section we now assume that the production process for each sector-region unit is characterized by two production functions for non-exports (N) and exports (X) respectively. Labor and capital are the standard input factors (L_n and K_n for producing non-exports, L_x and K_x for exports). The production function for non-exports has an additional production factor, i.e. exports (X), which specifies for each sector the local effect of exports on non-exports. Supressing indices we specify for each cross-section unit i and time period t

$$N = F(L_n, K_n, X), \tag{6}$$

$$X = G(L_x, K_x). \tag{7}$$

Feder (1982) assumes a productivity differential between exports and non-exports

$$\frac{G_k}{F_k} = \frac{G_l}{F_l} = 1 + \delta, \tag{8}$$

where the subscripts l and k denote partial derivatives with respect to L and K respectively. Marginal productivity in the export sector is higher, i.e. $\delta > 0$, because exporting firms have more efficient management and improved production techniques to face international competitive pressure. Also they face less constraints in the credit and foreign exchange markets (Feder, 1982).

Defining $Y = N + X$ we have by differentiation of (6) and (7) and assuming (8)

$$\dot{Y} = F_k(\dot{K}_n + \dot{K}_x) + F_l(\dot{L}_n + \dot{L}_x) + F_x\dot{X} + \delta(F_k\dot{K}_x + F_l\dot{L}_x), \tag{9}$$

where dots mean absolute changes. Note that differentiation of (7) and assuming (8) implies

$$\dot{X} = G_k\dot{K}_x + G_l\dot{L}_x = (1 + \delta)(F_k\dot{K}_x + F_l\dot{L}_x), \tag{10}$$

hence (9) can be written as

$$\dot{Y} = F_k\dot{K} + F_l\dot{L} + \left(\frac{\delta}{1 + \delta} + F_x\right)\dot{X}, \tag{11}$$

where $K = K_n + K_x$ and $L = L_n + L_x$. Assuming $F_l = \beta_l \frac{Y}{L}$ and $F_k = \beta_k \frac{Y}{K}$(for example Cobb-Douglas), leads to

$$\frac{\dot{Y}}{Y} = \beta_l \frac{\dot{L}}{L} + \beta_k \frac{\dot{K}}{K} + \left[F_x + \frac{\delta}{1+\delta} \right] \frac{X}{Y} \frac{\dot{X}}{X}. \tag{12}$$

Feder (1982) extended model (12) to take into account the differential effects of pure production differentials ($\frac{\delta}{1+\delta}$) and export externalities (F_x) on output. Assuming $N = X^\theta \psi(L_n, K_n)$ we have $F_x = \theta \frac{N}{X}$, i.e. the externality effect is parametrized by θ. Model (12) can be rewritten as

$$\frac{\dot{Y}}{Y} = \beta_l \frac{\dot{L}}{L} + \beta_k \frac{\dot{K}}{K} + \left[\frac{\delta}{1+\delta} - \theta \right] \frac{X}{Y} \frac{\dot{X}}{X} + \theta \frac{\dot{X}}{X}, \tag{13}$$

hence the externality effect is measured by θ and the productivity differential δ is captured in the coefficient of $\frac{X}{Y} \frac{\dot{X}}{X}$.

Note that the model above is in growth terms, hence it is capturing productivity growth effects only. However, due to lack of data on which part of sectoral output is for exports (we know Y, but not N and X) it is not possible to estimate production functions in levels as outlined in the previous subsection. Regarding specification (13) both cross-section and time specific effects have been added to take into account any unobserved time or cross-section invariant heterogeneity. Hence, based on (13) we estimate the following empirical specification

$$\Delta y_{it} = \beta' w_{it} + \eta_i + \lambda_t + \varepsilon_{it}, \tag{14}$$

with $\beta = (\beta_l, \beta_k, \beta_{sx}, \beta_x)'$ and $w_{it} = (\Delta l_{it}, \Delta k_{it}, S_{it} \Delta x_{it}, \Delta x_{it})'$ with x_{it} is the logarithm of exports and S_{it} the export ratio as before. From (13) and (14) it is seen that the externality effect θ is captured by the coefficient β_x, while we can retrieve an estimate of the productivity differential δ by the relation $\delta = \frac{\beta_{sx} + \beta_x}{1 - \beta_{sx} - \beta_x}$.

Estimation – Some sectors are absent in some regions and we simply have excluded zero observations from the analysis. Hence, of the total of 108 cross-section units only 95 have been included and the dimensions of the panel used in estimation are $T = 11$ and $N = 95$. We present estimation results[1] of specifications (5) and (14) using various techniques. We show least squares estimates, which in the literature on panel data models are called within or Least Squares Dummy Variables (LSDV) estimates. The LSDV estimator is simply ordinary least squares on a transformed model, i.e. where all observations are in deviations from individual time averages. It is well known that this estimator is biased and inconsistent (for finite T and large N) in panel data models with predetermined or endogenous regressors as the transformed explanatories will be correlated with the transformed disturbance terms. A prominent example is a model with autoregressive dynamics (Nickell, 1981), e.g. the empirical specification (5) in this study. Also, regarding production functions instantaneous or lagged feedback mechanisms from output to the input factors may exist resulting in lack of exogeneity of labor and capital variables in both specifications (5) and (14). For these reasons the use of instrumental variables techniques is warranted. Hence, efficient Generalized Method of Moments (GMM) estimation has been performed to get consistent estimates of the unknown parameters. Regarding the lagged dependent variable regressor in (5) we exploit all available moment conditions arising from the model assumptions. More in particular, following Arellano and Bond (1991) the levels equation has been first-differenced to eliminate the individual specific effects and moment conditions have been used involving lagged values of the dependent variable resulting in the so-called GMM-DIF estimator. The resulting set of moment conditions has been combined with moment conditions from the levels equation[2] (Arellano and Bover, 1995; Blundell and Bond, 1998) leading to the so-called

GMM-SYS estimator. Depending on the nature of the other explanatory variables more moment conditions are available, but not all of them have been used in estimation[3]. Both one-step and two-step GMM estimation has been performed, but only the latter is reported[4]. The two-step coefficient estimates are supplemented with bias-corrected asymptotic standard errors (Windmeijer, 2005) as it is well-known that uncorrected estimates lead to inaccurate and unreliable inference (Blundell and Bond, 1998).

EMPIRICAL RESULTS

Above we highlighted several data features about sectoral developments in Moroccan manufacturing for the period 1985-1995. Among other things we found negative cross-section and indeterminate time series correlations between labor productivity and export intensity. In this section we will focus in more detail on the empirical relationship between exports and productivity by using the empirical models discussed in the previous section.

Between sector productivity differentials – Table 3 presents the estimation results of specification (5). The results in Table 3 show that dynamics play an important role. In general, the estimated model seems adequate, i.e. imposing a more general lag structure does not lead to better diagnostics[5]. The long-term relation implied by the estimates of Table 3 are in Table 4. The long-term effects of labor and capital are elasticities, while those for the export indicators are semi-elasticities[6]. Regarding the explanatory variables related to standard production factors (labor and capital) we find for LSDV and GMM-DIF somewhat unsatisfactory results as the capital coefficient is not significant and the estimates imply decreasing returns to scale. Regarding LSDV this may be not surprising as this estimator is inconsistent. Regarding GMM-DIF Blundell and Bond (2000) argue that estimating production functions often such a pattern is observed, which is due to high persistence[7] in the data and, hence, the problem of weak instruments. They propose to rely on the GMM-SYS estimator, which gives more reasonable results in this context. Inspecting the GMM-SYS results we indeed find plausible labor and capital coefficients close to constant returns to scale. Regarding exports we find that export intensity has a significant negative effect on productivity levels, while the empirical evidence on productivity growth is positive although not significant at conventional significane levels.

The negative effect of export intensity on productivity levels can be explained by the fact that Moroccan manufacturing exports tend to concentrate in low labor productivity sectors. We documented already the negative cross-section and indeterminate time series correlations between labor productivity and export intensity. Hence, the estimated export intensity effect merely reflects a cross-section correlation than a time series effect. To decompose these effects we estimated simple within and between regressions (omitting the dynamics) by least squares. The dependent variable in these regressions is labor productivity (P), which is regressed on export intensity (S). The estimated within and between correlations are -0.17 and -1.06 (standard errors are 0.12 and 0.19 respectively). The cross-section correlation is significantly negative and relatively large, while over time a moderate negative and not significant correlation is found.

Based on this additional evidence we conclude that the estimated negative impact of export intensity on productivity levels is mainly due to pure sectoral productivity differentials, i.e. the fact that in Morocco especially labor intensive sectors export, and not that exporting diminishes productivity levels. On the other hand, it is clear from the current analysis that exporting does not contribute much to both productivity levels and growth over time, i.e. there is no significant evidence of sectoral wide local productivity externalities as a result of exporting.

Within sector productivity differentials – The empirical results above indicate that significant productivity differentials between firms in exporting and nonexporting sectors exist, but the evidence on productivity externalities is weak. We now use our second empirical model to assess if there are within sector productivity differentials too and if they can be contributed to local externalities from exporting to nonexporting firms. Table 5 presents the estimation results of specification (14). The estimate of δ shows positive productivity differentials between exporting and nonexporting firms although weakly significant only. In addition, some evidence is found for within sector productivity externalities, i.e. the coefficient θ (corresponding to the regressor Δx_{it}) is weakly significant. Summarizing, again there seems to exist a productivity differential between exporting and non-exporting firms, but the evidence on productivity externalities is weak.

CONCLUDING REMARKS

We have estimated several empirical models explaining productivity in Moroccan manufacturing by export performance. The empirical evidence is based on sectoral and regional data for 1985-1995, a period of relatively fast growing exports. The results show (1) across sectors a negative correlation between productivity and export orientation; (2) within sector higher productivity levels for exporting firms (although weakly significant only); (3) weakly significant productivity externalities from exporting both over time and to nonexporting firms. The negative correlation between productivity and exports across sectors reflects the fact that labor abundant sectors export most in Morocco. Analyzing Moroccan manufacturing employment Faini and de Melo (1996) find a similar result, i.e. a positive correlation between employment and export intensity. The second fact, i.e. within sectors exporting firms are more productive, is consistent with other recent empirical studies on Morocco based on firm level data (Clerides et al., 1998; Fafchamps et al., 2002). Finally, we conclude that these productivity differentials are not likely to be the result of any positive externalities due to exporting.

The absence of productivity externalities as a result of exporting can be explained by our finding that labor intensive, low productivity sectors export most in Moroccan manufacturing. Lall (1999) argues that especially high-technology export structures are beneficial as they are located in fast growing markets and have considerable scope for technological and knowledge spillovers. In contrast, the existing industrial export structure in Morocco is dominated by traditional low-tech industries. Firms operating in these industries can be characterized by traditional management systems and simple internal modes of organization. R&D expenditures are low and not well integrated with the production process (Khrouz et al., 2000). Firms are concerned primarily with the exploitation of inexpensive labor rather than the improvement of productivity levels and the introduction of technological and organizational innovations. Finally, Moroccan manufacturing exports lack diversification, i.e. are concentrated in few products and few markets (Worldbank, 1999). All these features limit the scope for export externalities and, hence, the existing export structure is not particular promising for sustained economic growth in Moroccan manufacturing.

APPENDIX

For the empirical analysis data have been used from the Ministère de l'Industrie et du Commerce (qui produit quoi au Maroc) and the Direction des Statistiques (annuaire statistique du Maroc). In total 18 two-digit industrial sectors are available: food products (10), other food products (11), beverages and tobacco (12), textiles (13), clothing (14), leather and shoes (15), wood products (16), paper and printing (17), mineral products (18), basic metals (19), metallic products (20), machinery and equipment (21), transport materials (22), electronics (23), precision equipment (24), chemical products (25), rubber and plastics (26) and other industrial products (27). In the data six urban areas are available, i.e. Casablanca, Rabat, Tangier, Fez, Meknes and Marrakech.

The variables employed in the analysis are value added (Y), production (Z), employment (L), exports (X) and a measure of capital stock (K). The latter variable has been constructed using deflated investment data (I), i.e.

$$K_{it} = (1 - g_K)K_{i,t-1} + I_{it}, , \qquad t = 2, ..., T, \tag{15}$$

assuming a constant annual depreciation rate g_K. To construct capital stock data for the first period we used a perpetual inventory method. Assuming a constant growth rate of past investments g_I we have

$$I_{it} = (1 + g_I)I_{i,t-1}, \qquad t = 1, 0, -1, ... \tag{16}$$

Combining (15) and (16) leads to

$$K_{i1} = \frac{1}{1 - \frac{1-g_K}{1+g_I}} I_{i1}. \tag{17}$$

In this study we have used $g_K = 0.04$ and $g_I = 0.088$. The depreciation rate has been taken from Haddad et al. (1996), while the growth rate of past investments has been set equal to the average annual growth rate of investments in the sample[8]. Furthermore, we define labor productivity and export intensity as $P = Y/L$ and $S = 100 * X/Z$ respectively. All nominal variables are measured in current dirhams, the local currency of Morocco. Nominal variables have been deflated into constant dirhams using sectoral price deflators. Employment is measured in total number of workers.

Notes

1. The Ox version of DPD (Doornik, Arellano and Bond, 2002) has been used for estimation.

2. This results in $T(T-1)/2 + T - 1$ moment conditions, i.e. $E\left[y_{i,t-s}\Delta\varepsilon_{it}\right] = 0$ $(t = 2, ..., T; s = 2, ..., t)$ and $E\left[\varepsilon_{it}\Delta y_{i,t-1}\right] = 0$ $(t = 2, ..., T)$. To economize on the total number of instruments we use moment conditions for $s = 2, 3$ only.

3. We assume endogeneity of labor and capital, which for these variables leads to similar moment conditions as in the previous note, but only at lags 2 and 3 to economize on the total number of moment conditions. We assume strict exogeneity for the export related variables, in which case we use the regressor itself as an instrument.

4. For all estimation results in this study it happens to be the case that one-step estimates are very close to two-step estimates.

5. The statistics $m1$ and $m2$ test for first-order and second-order residual autocorrelation

in the first-differenced residuals. Under the null hypothesis of no serial correlation they have an $\mathcal{N}(0,1)$ distribution. *Sargan* is a test of over-identifying restrictions and has an χ^2 distribution under the null of validity of both specification and instruments.

6. Standard errors have been calculated using the Delta method. Defining $\pi = (\pi_0, \pi_1', \pi_2')'$ and using GMM we have $\hat{\pi} \xrightarrow{a} \mathcal{N}(\pi, V_\pi)$. The Delta method can be used to obtain the asymptotic distribution of continuous and differentiable functions of π. Regarding the long-run effects $\phi = (\pi_1 + \pi_2)/(1 - \pi_0) = h(\pi)$ in Table 4 applying the Delta method we have $\hat{\phi} \xrightarrow{a} \mathcal{N}(\phi,\ HV_\pi H')$ where $H = \partial h(\pi)/\partial \pi'$. From this result asymptotic standard errors for the elements of ϕ can be calculated.

7. GMM-SYS estimation of simple AR(1) specifications for individual series shows considerable persistence, i.e. the estimated AR(1) coefficients for y, l and k are 0.75, 0.91 and 0.65 respectively.

8. We experimented with alternative values for g_K and g_I, but the estimation results hardly change.

Acknowledgements

We thank two anonymous referees for their constructive remarks. The research of the first author has been funded by the NWO Vernieuwingsimpuls research grant "Empirical Comparison of Economic Models".

References

ARELLANO, M. & S. BOND (1991), Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58, pp. 277-297.

ARELLANO, M. & O. BOVER (1995), Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics* 68, pp. 29-51.

BERNARD, A.B., & J.B. JENSEN (1999), Exceptional exporter performance: cause, effect, or both? *Journal of International Economics* 47, pp. 1-25.

BLUNDELL, R. & S. BOND (1998), Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics* 87, pp. 115-143.

BLUNDELL, R. & S. BOND (2000), GMM estimation with persistent panel data: an application to production functions. *Econometric Reviews* 19, pp. 321-340.

CLERIDES, S., LACH, S. & TYBOUT, J. (1998), Is learning-by-exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *Quarterly Journal of Economics* 113, pp. 903-947.

DOORNIK, J.A., ARELLANO, M., & S. BOND (2002), Panel Data estimation using DPD for Ox. University of Oxford.

EDWARDS, S. (1993), Openness, trade liberalization, and growth in developing countries. *Journal of Economic Literature* 31, pp. 1358-1393.

FAFCHAMPS, M., EL HAMINE, S. & A. ZEUFACK (2002), Learning to export: evidence from Moroccan manufacturing. *Worldbank Working Paper* no. 2827. Washington DC: Worldbank.

FAINI, R., & J. DE MELO (1996), Trade policy, employment and migration: some results for Morocco. *In*: E. Taylor, ed., *Development Strategy, Employment and Migration*, pp. 63-86. OECD Development Centre Studies.

FEDER, G. (1982), On exports and economic growth. *Journal of Development Economics* 12, pp. 59-73.

HADDAD, M., DE MELO, J. & B. HORTON (1996), Morocco 1984-89: Trade liberalization, exports and industrial performance, *In*: Roberts, M.J. and J.R. Tybout, eds., *Industrial evolution in developing countries: micro patterns of turnover, productivity and market structure*. Oxford: Oxford University Press.

HENDRY, D.F., PAGAN, A.R. & J.D. SARGAN (1984), Dynamic specification, *In*: Griliches, Z. and M.D. Intriligator, eds., *Handbook of Econometrics Vol. 2*, pp. 1023-1100. The Netherlands: Elsevier Science Publishers.

İŞCAN, T. (1998), Trade liberalization and productivity: a panel study of the Mexican manufacturing industry. *Journal of Development Studies* 34, pp. 123-148.

KHROUZ, D., HAJJI, A. & M. BOUSETTA (2000), The development research environment in Morocco: situation and prospects, *In*: Rached, E. and D. Craissati, eds., *Research for development in the Middle East and North Africa*. Canada: International Development Research Centre.

LALL, S (1999), India's manufactured exports: comparative structure and prospects. *World Development* 27, pp. 1769-1786.

NICKELL, S. (1981), Biases in dynamic models with fixed effects. *Econometrica* 49, pp. 1417-1426.

NICKELL, S.J. (1996), Competition and corporate performance. *Journal of Political Econ-*

omy 104, pp. 724-746.

WINDMEIJER, F. (2005), A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics* 126, pp. 25-51.

WORLD BANK (1999), *Kingdom of Morocco, Private sector assessment update: Fulfilling the promise of private sector-led growth*. World Bank report no. 19975-MOR. Washington DC: Worldbank.

Table 1. *Descriptive statistics*

	Y	L	K	X	P	S
level 1985	103.77	2.21	152.53	48.08	46.86	11.50
level 1995	205.34	3.55	408.58	131.69	57.77	21.84
growth 85-90	7.92	7.59	10.16	25.32	0.22	16.87
growth 91-95	3.30	1.05	8.25	0.03	2.14	-0.70

Note: Y, K and X in millions of constant dirhams, L in thousands of workers, P in thousands per worker and S between 0 and 100; Level is average level, growth is average annual growth.

Table 2. *Sectoral labor productivity (P) and export orientation (S)*

	P		S	
	1985	1995	1985	1995
10 Food products	39.7	71.3	0.9	12.4
11 Other food products	34.6	37.2	20.4	27.6
12 Beverages and tobacco	206.6	537.0	1.6	0.9
13 Textiles	25.1	38.2	24.1	41.4
14 Clothing	28.1	22.8	81.9	91.0
15 Leather and shoes	25.7	38.5	39.5	60.0
16 Wood products	30.9	37.8	19.1	25.2
17 Paper and printing	51.4	87.0	8.7	15.1
18 Mineral products	62.2	76.4	1.7	2.6
19 Basic metals	110.8	98.9	10.8	12.2
20 Metallic products	45.5	56.0	2.5	5.1
21 Machinery and equipment	42.7	56.0	0.3	4.0
22 Transport materials	91.8	115.5	6.5	19.9
23 Electronics	50.6	75.4	13.2	22.0
24 Precision equipment	68.5	28.4	7.9	19.9
25 Chemical products	96.6	98.1	44.9	38.1
26 Rubber and plastics	46.7	62.6	3.8	11.9
27 Other industrial	30.3	28.8	9.4	8.0

Note: see Table 1

Table 3. *Short-run estimation results of specification (5)*

	LSDV	GMM-DIF	GMM-SYS
$y_{i,t-1}$	0.35 (0.05)	0.37 (0.09)	0.64 (0.06)
l_{it}	0.76 (0.10)	0.65 (0.10)	0.74 (0.10)
$l_{i,t-1}$	-0.26 (0.07)	-0.25 (0.09)	-0.40 (0.11)
k_{it}	0.06 (0.03)	0.07 (0.03)	0.13 (0.04)
$k_{i,t-1}$	-0.04 (0.02)	-0.04 (0.02)	-0.08 (0.03)
s^l_{it}	-0.29 (0.07)	-0.33 (0.06)	-0.29 (0.06)
$s^l_{i,t-1}$	-0.05 (0.14)	-0.22 (0.09)	-0.16 (0.07)
s^g_{it}	0.02 (0.02)	0.03 (0.02)	0.01 (0.01)
$m1$		-4.12 (0.00)	-4.98 (0.00)
$m2$		-0.36 (0.72)	0.43 (0.67)
$Sargan$		53.17 (0.35)	77.36 (0.47)

Note: Figures in parentheses under estimates and behind test statistics are standard errors and p-values respectively. The results are robust to general heteroskedasticity patterns across individuals and over time.

Table 4. *Long-run estimation results of specification (5)*

	LSDV	GMM-DIF	GMM-SYS
l_{it}	0.78 (0.14)	0.63 (0.12)	0.91 (0.08)
k_{it}	0.04 (0.04)	0.04 (0.04)	0.14 (0.06)
s^l_{it}	-0.53 (0.25)	-0.89 (0.23)	-1.23 (0.27)
s^g_{it}	0.03 (0.03)	0.05 (0.04)	0.03 (0.04)

Note: see Table 3.

Table 5. *Estimation results of specification (14)*

	LSDV	GMM-DIF	GMM-SYS
Δl_{it}	0.74 (0.11)	0.70 (0.11)	0.70 (0.10)
Δk_{it}	0.10 (0.04)	0.09 (0.05)	0.11 (0.04)
$S_{it}\Delta x_{it}$	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Δx_{it}	0.14 (0.12)	0.13 (0.13)	0.12 (0.11)
δ	0.18 (0.16)	0.14 (0.17)	0.14 (0.14)
$m1$		-5.39 (0.00)	-5.40 (0.00)
$m2$		0.58 (0.56)	0.63 (0.53)
$Sargan$		30.64 (0.43)	40.47 (0.77)

Note: see Table 3.