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TUNISIA

Selected Issues

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Approved by Middle East and Central Asia Department

October 12, 2004

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I. Assessing Reserves Adequacy in Tunisia [1]

A. Summary

1. **Tunisia foreign exchange reserves increased over the last decade.** They rose from 1.6 months of imports and 62 percent of short term external debt in 1992 to about 3 months of imports and 100 percent of short term external debt in 2003.

2. **The demand for foreign exchange reserves is well explained by key fundamentals.** Foreign exchange reserves are positively correlated with economic size and current account vulnerability, and negatively correlated with exchange rate flexibility and the opportunity costs of holding reserves.

3. **The estimated long run relationship between foreign reserves holdings and their determinants yields a demand for reserves that is lower than currently forecasted in Tunisia's medium term macroeconomic framework.** The model estimates that 2.5 months of reserves corresponding to 84 percent of short term debt coverage would be appropriate given balance of payments forecasts. Tunisia's medium term scenario builds reserves equivalent to 3 months of imports and 105 percent of short term external debt coverage.

4. **The planned gradual move to a floating exchange rate regime could further reduce the demand for reserves.** However, increased exchange rate volatility in the transition to floating regime and possible new balance of payments risks emanating from capital account liberalization could require a reserve cushion to allow for some central bank intervention. As increased exchange rate flexibility fosters market liquidity, which helps reduce market volatility, the demand for larger reserves should diminish in view of the opportunity costs of holding reserves. Moderate reserve coverage would also avoid providing incentives for inappropriate debt management practices. Sound liability management by both the public and private sectors reduces the need for foreign exchange reserves.

B. Introduction

5. **Foreign exchange reserves adequacy is a key component of good macroeconomic management.** Foreign exchange reserves can be used to smooth random and temporary balance of payments shocks to maintain an exchange rate parity, avoid the macroeconomic costs of adjustment to temporary shocks, and smooth adjustment to the macroeconomic impact of some permanent shocks. Foreign reserves can also be used to smooth exchange rate volatility in illiquid foreign exchange markets. Foreign exchange reserves holdings, however, imply an opportunity cost usually defined as the difference between the highest possible return forgone from an alternative investment and the yield on foreign reserves. For these

[1] Prepared by Abdourahmane Sarr.

reasons, an analysis of the adequacy of reserves is important for sound macroeconomic management.

6. **Econometric evidence in emerging market countries (IMF, 2003) shows that the demand for international reserves can be reasonably explained and forecasted using key fundamentals.** In a panel setting, the econometric evidence showed that reserves holdings depend positively on measures of an economy's size and external vulnerability, and negatively on exchange rate flexibility and opportunity costs of holding reserves.

7. **The goal of this paper is to apply IMF (2003) to uncover the long run determinants of the demand for foreign exchange reserves in Tunisia, and to assess the adequacy of current and projected reserves holdings in light of the country's policy choices.** The Tunisian authorities have decided to gradually liberalize the capital account of the balance of payments to accompany the country's increased integration (trade and financial) into the world economy. To minimize the risks of increased international integration[2] and to maintain monetary policy independence in an open capital account environment, the Central Bank of Tunisia (BCT) is gradually moving from a real effective exchange rate targeting framework to a floating exchange rate regime. To this end, the BCT is implementing a new monetary framework that defines price stability as its primary objective. The framework adopts broad money as the reference intermediate target of monetary policy to achieve an inflation target and base money as the operating target. [3] While the planned move to a flexible exchange rate regime should reduce the need for holding large reserves, foreign exchange reserves could still be needed for precautionary reasons and to prevent excessive short term exchange rate volatility.

8. **The paper is organized as follows.** Section C describes recent trends in foreign exchange reserves in Tunisia. Section C also discusses measures of liquidity in the foreign exchange market since a more liquid foreign exchange market reduces the need for central bank intervention to smooth volatility. Section D presents econometric evidence on the determinants of the demand for foreign reserves in Tunisia. The results are used to forecast the desired level of reserves given Tunisia's medium term macroeconomic framework and to draw policy implications.

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[2] The potential risks are the loss of external competitiveness as trade integration increases and the provision of an exchange rate guarantee to investors as financial integration intensifies.

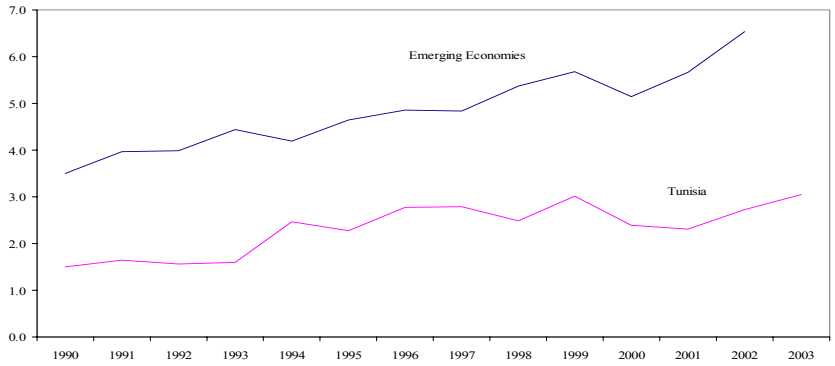
[3] See Laurens and Sarr (IMF Country Report 03/259, 8/21/03; and IMF Country Report 02/120, 6.17/02) for a description of the monetary policy framework and planned sequencing of capital account liberalization). These papers also discuss the structural policies that support a flexible exchange rate regime, namely deep foreign exchange and money markets, and a healthy and well supervised financial sector.

C. Foreign Exchange Reserves and Markets in Tunisia

Trends in Foreign Exchange Reserves

9. **Foreign exchange reserves in Tunisia increased over the last decade (Charts 1, 2, and 3).** They rose from 1.6 months of imports of goods and services in 1990 to about 3 months in 2003 and represent US$ 3 billion. Over the same period, the ratio of reserves to short term external debt increased from 52 percent to about 100 percent.[4] These ratios are somewhat lower than in many other emerging market countries where reserves accumulation in recent years appears to have been higher than justified by fundamentals (IMF, 2003). The short-term debt reserves coverage in Tunisia appears more than adequate judging by the 100 percent benchmark coverage, which empirical evidence (Bussière and Mulder, 1999) has determined is adequate to avert capital account crises in emerging market countries. Bussière and Mulder (1999) note, however, that the presence of a current account deficit or an overvalued exchange rate would require more reserves. In this regard, the 3 months of reserves coverage that has often been used as a benchmark cushion for current account related vulnerabilities remains a rule of thumb. The IMF (2003) empirical framework analyzing the determinants of the demand for foreign reserves would therefore be useful to shed further light on reserves adequacy in Tunisia.

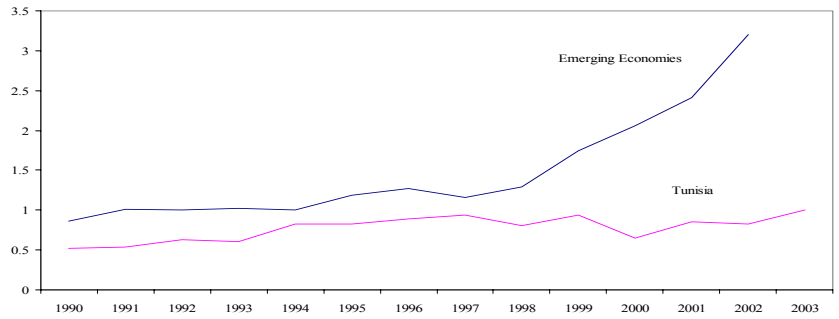
Chart 1. Reserves in Months of Imports



Source: IMF (2003) and staff estimates.

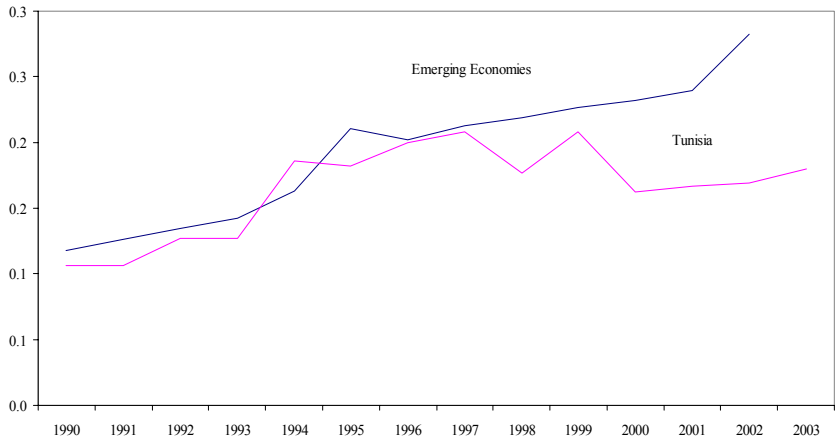
[4] Short term debt includes current amortization and non-residents' deposits and excludes suppliers' credit. Deposits of residents in foreign currency and local currency convertible into foreign currency are negligible (less than 0.3 percent of M3), and there is no foreign currency public debt to residents. There is, therefore, no need for augmented reserve coverage indicators that would include these liabilities.

Chart 2. Reserves to Short Term Debt



Source: IMF (2003) and staff estimates

Chart 3. Reserves to Broad Money



Source: IMF (2003) and staff estimates.

Foreign Exchange Market

10. **Tunisia liberalized its foreign exchange market in 1994 when an interbank market was created.** The BCT gradually reduced its market presence giving financial institutions more role in managing foreign exchange flows. Transactions among financial institutions, thus, represented 80 percent of dinar/foreign exchange transactions in 2003 and 100 percent of transactions amongst foreign currencies (Table 1). Forward and swap markets have also been created, although turnover in these markets is low relative to the spot market.

Table 1 Dinar/Foreign Currency Transactions
(In millions of US dollars)

	Spot	Forward	Swaps	Total
2000	6347	509	...	6857
2001	6881	564	1514	8959
2002	6673	731	1492	8896
2003	6779	798	372	7949

Spot transactions

	Share 1/	Central Bank	Interbank	Total
1998	...	1717	3394	5111
1999	...	886	3547	4433
2000	70.9	2410	3938	6347
2001	76.8	2074	4807	6881
2002	75.0	1932	4740	6673
2003	85.3	1173	5606	6779

Source: Tunisian authorities.

1/ In percent of total dinar/foreign currency transactions

11. **Total turnover in the foreign exchange market has however stagnated in recent years.** This could be due to several factors that inhibit market activity. A foreign exchange surrender requirement, which the BCT reduced from 50 percent to 30 percent in 2003, still exists. Banks are required to close their foreign exchange positions if a loss greater than 3 percent is incurred on the position even though they are allowed to hold positions up to 20 percent of their capital. Banks' role in managing their foreign exchange holdings is limited by an obligation to deposit end-of-day foreign exchange balances at the central bank, which the BCT plans to eliminate. The BCT posts daily bid/ask spread dinar quotes, thereby reducing exchange rate uncertainty in the market. The market bid ask spread has remained relatively stable at 25 basis points, and daily exchange rate variations average below 0.5 percent reflecting limited market uncertainty (Charts 4 and 5). No noticeable improvement in market liquidity measured by market turnover and the ratio of exchange rate volatility to turnover (Charts 6 and 7) can be observed in recent years.[5] The planned increase in exchange rate flexibility and elimination of BCT bid/ask quotes should help develop market activity provided banks are given more latitude to take open positions.

12. **In a context of increased exchange rate flexibility, the BCT might need to intervene in the foreign exchange market only to limit market volatility.** Market volatility is currently low in part because of market practices discussed above. Volatility could increase in the future as financial institutions are given a larger role in determining the exchange rate. As this occurs, the current flexible real effective exchange rate targeting framework could be used to define an exchange rate band, which would guide short term intervention policy when the BCT ceases to post daily bid ask spreads of the dinar. The BCT would however need to gradually move away from this policy to avoid market perception of an exchange rate guarantee (Duttagupta et al, 2004). Ultimately, foreign exchange intervention may need to be limited to announced annual foreign exchange reserves accumulation targets that the long run determinants of the demand for foreign exchange reserves discussed below would suggest.

D. Econometric Evidence on the Determinants of Foreign Exchange Reserves

13. **Following on IMF (2003), we estimated bivariate regressions between real reserves and its determinants (Table 2).** IMF (2003) measured economic size by population and real GDP per capita; current account vulnerability by openness to trade and exports volatility[6]; capital account vulnerability by financial openness and potential for capital flight by residents; exchange rate flexibility by the actual volatility of the exchange rate; and the opportunity cost of holding reserves by the difference between domestic and foreign interest rates. The bivariate regressions indicate that foreign reserves and most of its identified determinants have the expected correlation signs. Foreign reserves vary positively

[5] See Sarr and Lybek (2002) for a discussion of liquidity measures.

[6] We replaced exports volatility by the current account deficit to GDP as a measure of current account vulnerability in our single country empirical context and annual exports data.

with measures of economic size and current and capital account vulnerability, and negatively with exchange rate flexibility and the opportunity cost of holding reserves. In the multi-variable regression, best results are obtained when economic size is captured by the logarithm of real GDP per capita and current account vulnerability by openness to trade (imports plus exports relative to GDP) and the current account deficit relative to GDP.

Chart 4: Bid/Ask Spread (basis points)
(Dinar/US Dollar Exchange Rate)

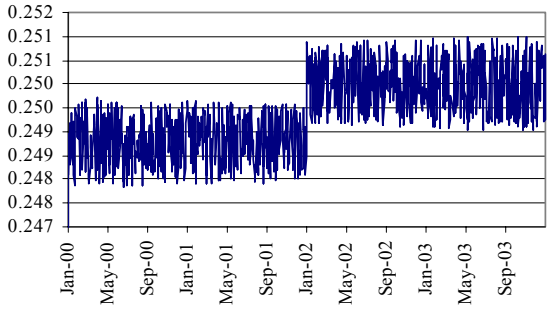


Chart 5: Absolute Value of Daily % Changes
in Dinar/Dollar Exchange Rate

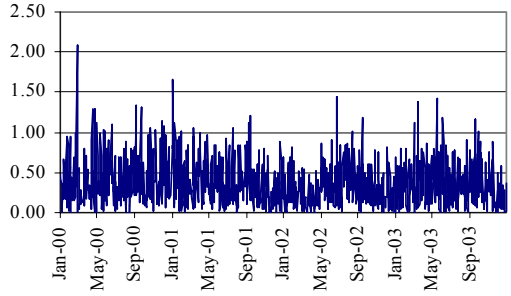


Chart 6: Turnover (value traded)
(in millions of dinars)

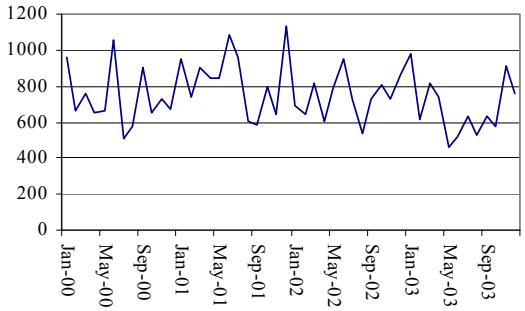
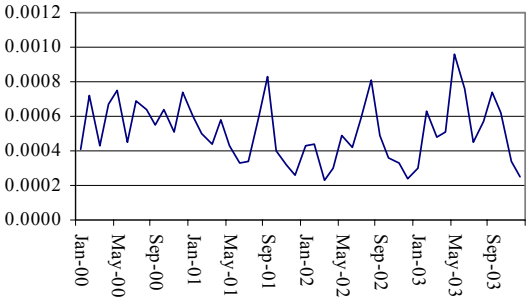


Chart 7: Conventional Liquidity Ratio
(Daily Absolute Exchange Rate Changes over
Value Traded)



Source: Tunisian authorities.

14. **The data series, however, have unit roots implying that a regression of foreign reserves on its determinants could be spurious unless the variables are cointegrated.** The best-fit multiple regression (Table 2, Equation 1) has good residuals' properties and the OLS Engle Granger procedure for cointegration indicates that its residuals are stationary (Table 3). This suggests that the variables are cointegrated and the estimated equation is a long run relationship. The Johansen VAR procedure (Table 4) also indicates that the variables are cointegrated confirming that equation (1) is not spurious. Both λ_{max} and λ_{trace}

statistics, however, suggest that there are two cointegrating vectors. [7] The existence of another cointegrating relationship, and the potential misspecification of foreign reserves explanatory variables' equations in the VAR setting may be a reason why some of the variables do not have expected signs in the long-run foreign reserves equation estimated by the Johansen procedure. In fact, real GDP per capita and the current account balance to GDP are not significant in the VAR estimated long run relationship.

Table 2. Determinants of Foreign Exchange Reserves (OLS)

	Bilateral Regressions	Equation (1) Multiple-Variable Regressions
Variables		
Economic size		
Log of real GDP per capita	14.83**	24.09**
Log of population	15.44**	
Current account vulnerability		
Ratio of imports to GDP	40.04**	
Ratio of imports+exports to GDP	23.49**	18.09*
Current account deficit to GDP	72.28*	34.59*
Capital account vulnerability		
Ratio of nonresident portfolio flows to GDP	-16.06	
Ratio of M3 to GDP	46.40**	
Short-term external debt to GDP	2.09	
Exchange rate flexibility		
Standard deviation of dinar/US$ dollar rate	-2.19+	-1.53+
Opportunity Cost		
Short-term nominal interest rate different	-0.11	0.35*
		constant -172.2**
		R^2 0.895
	Residuals Properties	
	AR 1-2 test : F(2, 11)= 0.041 prob (0.96)	
	ARCH 1-1test : F(1, 11)= 0.125 prob (0.72)	
	Normality Test: Chi 2 = 2.027 prob (0.36)	
	Hetero-Test : F(10,2) =0.1199 prob (0.99)	
	Reset Test : F (1, 12)=0.084 prob (0.77)	

**, *, and + denote significance at the 1 percent, 5 percent, and 10 percent levels respectively.
Sample period covers 1969-2003 for bilateral regressions depending on data availability and 1982–2003 for the multi-variable regression.

[7] Weak exogeneity was rejected, implying that a test of cointegration using a single equation error correction model of foreign reserves would not be appropriate.

Table 3. Augmented Dickey Fuller Tests for Unit Roots

Variables	(In levels)					
	Constant			No Constant		
	t-ADF	beta	Lag (AIC)	t-ADF	beta	Lag (AIC)
rrmg	-1.86	0.77	0	0.53	1.02	0
lrgdpc	1.07	1.01	0	4.82	1.00	0
opent	-2.43	0.59	0	'1.61	1.03	3
volexr	-3.38**	0.14	0	-1.60	0.91	0
ratedif	-1.44	0.72	0	-0.93	0.90	0
cagdp	-4.85**	-0.49	3	-1.60	0.75	0
Resid	-3.37*	-0.07	0	-3.51**	-0.07	0
	(In first differences)					
	t-ADF	beta	Lag (AIC)			
rrmg	-4.77**	-1.39	3			
lrgdpc	-5.24**	-0.11	0			
opent	-3.64**	-0.58	2			
volexr	-4.81**	-0.29	0			
ratedif	-2.69*	0.26	0			
cagdp	-4.69**	-0.07	0			

Rrmg = real reserves minus gold ; lrgdpc=log of real GDP per capita; opent=ratio imports and exports to GDP; volexr = standard deviation of monthly dinar/dollar exchange rate; ratedif=nominal short term interest rate differential between the United States and Tunisia; cagdp=current account deficit to GDP
Resid = residuals of Equation 1 in Table 2
** and * mean significance at the 1 percent and 5 percent levels respectively.
Samples are from 1987 to 2002

Table 4 Cointegration Analysis (Johansen methodology)

	Cointegration tests	
	λtrace	λmax
rank		
0	130.4**	48.21**
1	82.23*	35.44*
2	46.79	22.42
3	24.36	11.24
4	13.12	7.33

Cointegrating Vector (β) normalized on reserves

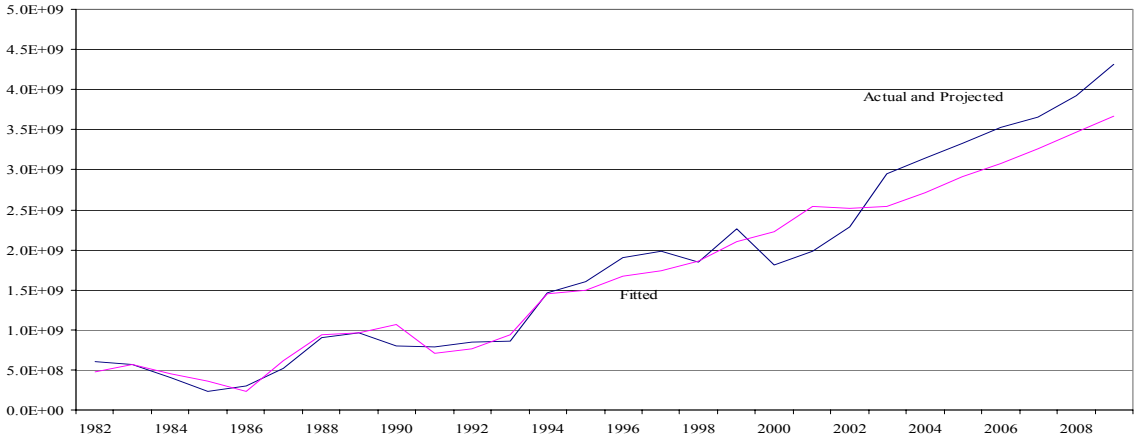
lrgdpc	opent	cagdp	ratedif	volexr
53.70	-65.24**	37.87	1.57*	-15.60**

** and * denote significance at the 1 percent and 5 percent levels
Sample is 1983-2001. Variable are as defined in Table 3

15. **Equation 1 is, therefore, our preferred long run relationship.** Coefficients in equation 1 have the expected signs and produce good in sample forecasts of the level of reserves (Chart 8).

(Equation 1) -172.21 + 24.086*LRGDPC -1.535*VOLEXR + 18.097* OPENT -0.347*RATEDIF+ 34.59*CAGDP
(-5.77) (5.34) (-1.78) (2.46) (-1.99) (2.00)

Chart 8: Fitted vs Actual and Projected Reserves
(in US dollars)



Source: Staff estimates.

16. **The projected reserves in Tunisia's current macroeconomic framework are somewhat higher than forecasted using the estimated long run equation 1.** The projected foreign reserves build up would hold reserves at 3 months of imports and 105 percent of short term debt in the medium term. Equation 1 suggests that 2.5 months of reserves coverage (closer to the 10 year historical average of 2.7 months), and 85 percent of short term debt coverage may be appropriate. The fitted values are based on the average exchange rate volatility of the last 3 years and an interest rate differential of about 200 basis points. As exchange rate flexibility increases, the need for holding reserves should further diminish. Increased exchange rate volatility in a more flexible exchange rate environment and possible new balance of payments risks emanating from capital account liberalization could, however, require a reserve cushion to allow for central bank intervention. As increased exchange rate flexibility fosters market liquidity, which reduces market volatility, the demand for larger reserves should diminish in view of the opportunity costs of holding reserves. Moderate

coverage of short term external liabilities may also encourage better private and public sectors debt management. As noted in IMF, 2004, sound liability management by both the public and private sectors should play a major role in containing exposures and rollover risks, and help reduce the need for foreign exchange reserves.

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II. Is Tunisia Trading to its Potential?[8]

A. Introduction

17. **Tunisia's trade performance is crucial to the country's growth prospects.** As one of the pioneers in the Barcelona process—the major integration initiative between the European Union (EU) and Southern and Eastern Mediterranean countries—Tunisia signed an Association Agreement with the EU (AAEU) in 1995. In 2004, the Agadir treaty was signed, which foresees a free trade zone between Egypt, Jordan, Morocco, and Tunisia. The Agadir treaty also has important provisions for rules of origin, allowing for accumulation of origin among all parties and the EU. Tunisia also has bilateral trade agreements with Kuwait, Libya and Syria and is negotiating another with Algeria.

18. **However, while strong export growth has contributed to place Tunisia in the lead in the region in terms of economic performance, it has not been sufficient to fulfill Tunisia's objectives of approaching lower-tier OECD income levels and significantly lower unemployment.** To achieve this goal, further trade liberalization and trade facilitation will be important for at least two reasons:

- **To further improve its economic performance in a durable manner, Tunisia needs to accelerate productivity growth.** Increased trade openness can contribute to productivity growth through a more efficient allocation of resources, technology transfers, access to a wider range of inputs, competitive pressure, and scale effects.

- **To ensure external sustainability and sufficient demand, Tunisia's growth needs to be largely export-driven.** Tunisia's relatively high external debt (around 60 percent of GDP) constitutes a source of external vulnerability that would be substantially mitigated by continued strong export growth. In addition, given Tunisia's small size, exports is likely to remain the most viable engine of growth.

19. **This study attempts to quantify the scope for increasing Tunisia's trade.** The analysis uses a gravity model of bilateral trade applied to a database covering some 90 countries accounting for over 85 percent of total world trade. The gravity model predicts the "normal" levels of bilateral trade based on a number of characteristics of the countries involved. It can be considered as a global benchmark for trade patterns that would arise if all countries faced the same obstacles to trade (broadly defined) as the current "average" country. Tunisia's actual level of trade can thus be compared to the benchmark to assess the potential to increase trade with individual countries. While the exact magnitude of such estimates should be treated with a degree of caution, they can provide guidance to (a) what are Tunisia's prospects of significantly increasing trade over the medium to long term, given

[8] Prepared by Ludvig Söderling.

enabling structural reforms; and (b) which countries present the greatest untapped potential for increasing trade.

B. Estimating Tunisia's Trade Potential

Analytical framework: the gravity model of bilateral trade

20. The gravity model is a tool often used to analyze bilateral trade patterns. Its simplicity and high level of statistical explanatory power have contributed to promoting its wide use. The basic gravity model relates some measure of bilateral trade (imports, exports, or both) to the economic size of two countries, and the geographical distance between them. Population (or GDP per capita), is often also included, along with other variables that could influence bilateral trade. The specification used here is (in logs, suppressing time subscripts for notational convenience):

$$M_{ij} = \alpha Y_i + \beta Y_j + \lambda P_i + \delta P_j + \phi D_{ij} + \phi X_{ij} + u_{ij}$$

where M_{ij} is the nominal value of imports to country i from country j. Y_i and Y_j are nominal GDP in country i and j respectively, P_i and P_j are population in country i and j, D_{ij} is the distance between country i and j, X_{ij} is a vector of variables describing either country i or j, or both. This vector includes the share of agriculture in GDP of the exporting country, the number of landlocked countries in the country pair (i.e., 0, 1, or 2), and dummy variables for trade between partners sharing the same language, for partners bordering each other, for partners where one colonized the other at some point in time, and for primary commodity exporters.[9] To control for potential differences in north-north trade compared to trade involving developing countries (e.g. differences in the quality of infrastructure, human capital, labor and environmental standards etc.) a dummy for inter-industrial country trade is included. u_{ij} is described as (including time subscripts for clarity):

$$u_{ijt} = \mu_{ij} + \varepsilon_{ijt},$$

where μ_{ij} are unobservable, time-invariant country pair-specific effects assumed to be uncorrelated with the other explanatory variables. ε_{ijt}, is a normally distributed error term with zero mean.

21. Bilateral trade can be expected to depend positively on the size of the two economies, measured by GDP, and negatively on the distance between the countries. A large population is generally considered to relate negatively to trade, since this would imply a larger domestic market and a higher degree of auto-sufficiency. Moreover, for a given level of GDP, a larger population indicates a lower level of per capita income (a proxy for economic development)

[9] All dummies take the value 1 or 0.

and hence generally a lower export capacity. It has, however, also been argued that a large population allows for scale effects and a more efficient division of labor and would therefore affect trade positively. Hence, the expected sign of the population of the exporting country is ambiguous in the model. Trade is likely to be higher between bordering countries[10], countries sharing a common language, and countries with colonial ties, and lower for landlocked countries. The share of agriculture in GDP can be expected to correlate negatively to exports, since trade protection tends to be particularly high against agricultural products. Trade in primary commodities should ideally be excluded from the gravity model, given that terms of trade swings can cause significant volatility in the value of trade. However, IMF's Direction of Trade Statistics (DOTS) provides data for total trade only, and the issue is instead addressed by including a dummy for commodity exporters.[11] There is no strong *a priory* reason for this dummy to be positive or negative.

Empirical results

22. The econometric analysis is based on a panel dataset covering bilateral trade between 90 developing and industrialized countries for the period 1991–2002.[12] The results from this global model are applied to actual data for Tunisia to determine that country's benchmark level of bilateral trade. To smooth some of the volatility in the trade data, and limit the risk of calculating trade potentials based on unusual trade performances in a particular year, three-year averages are calculated for the periods 1991–93, 1994–96, 1997–99, and 2000–02. A random effects Tobit model is used for the estimations and pooled Tobit and OLS results are also reported for comparison (see the appendix for estimation results and a note on econometric issues). Time dummies are included in all regressions to control for time-specific events. The regressions yield reasonable results, with essentially all variables having the expected sign (perhaps with the exception of the dummy for north-north trade, which has a negative coefficient), nearly all significant at the 1 percent level. The results are robust to the inclusion or exclusion of intra-industrial (north-north) trade.

23. Tunisia's trade potential is defined as the difference between the benchmark level of trade predicted by the model (2000–02 averages fitted to equation 1 in Table 1 in the appendix) and actual levels of bilateral trade. In other words, a positive trade potential indicates that Tunisia under-trades with the country in question, while negative potentials

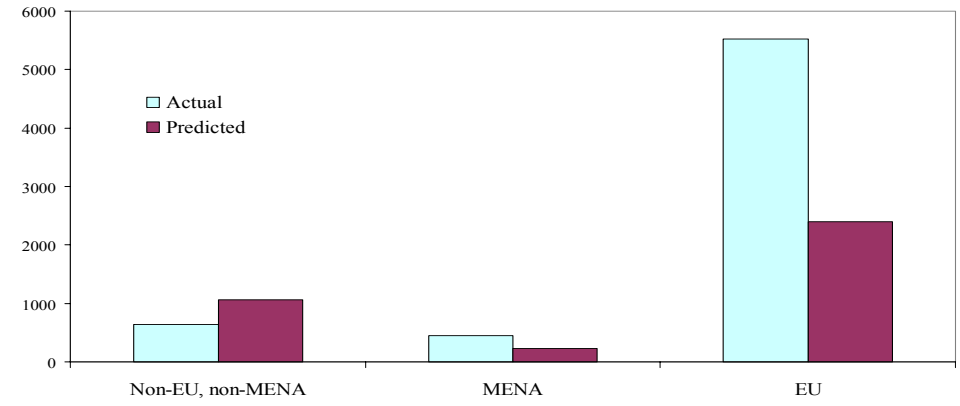
[10] Although true in general, this is evidently not the case when cross-border traffic is restricted due to political or other conflicts.

[11] The UN's COMTRADE database does provide information on trade by major product group. Exploiting this could be useful for further research.

[12] For another application on the same data, see Chapter II of the Selected Issues papers for the 2004 Article IV consultation for Morocco (IMF Country Report 04/164, 6/9//04).

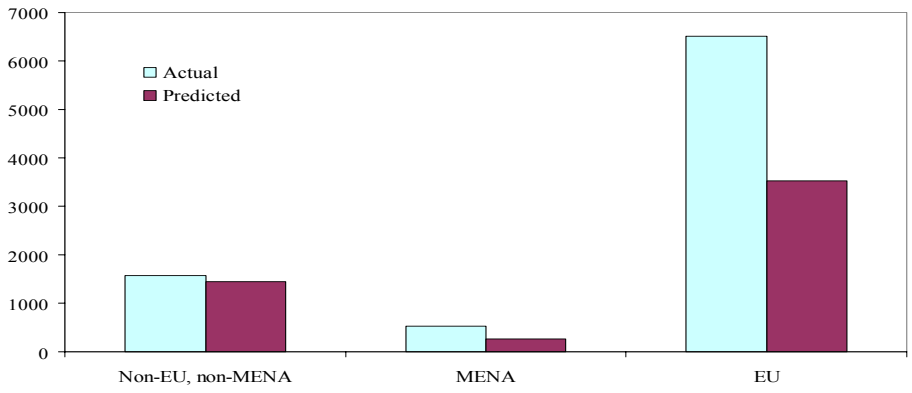
signify trade beyond predicted levels.[13] These trade potentials are analyzed on a country-by-country basis rather than in the aggregate, since over-trading with one country cannot be seen as neutralizing a positive trade potential with another. Tunisia's trade partners are divided into three regional groupings: the EU (pre-2004 accessions), Middle East and North Africa (MENA), and the rest of the world.[14]

Chart 1. Tunisian Exports
(average 1999–2002 in US$ million)



Source: IMF staff calculations

Chart 2. Tunisian Imports
(average 1999–2002 in US$ million)



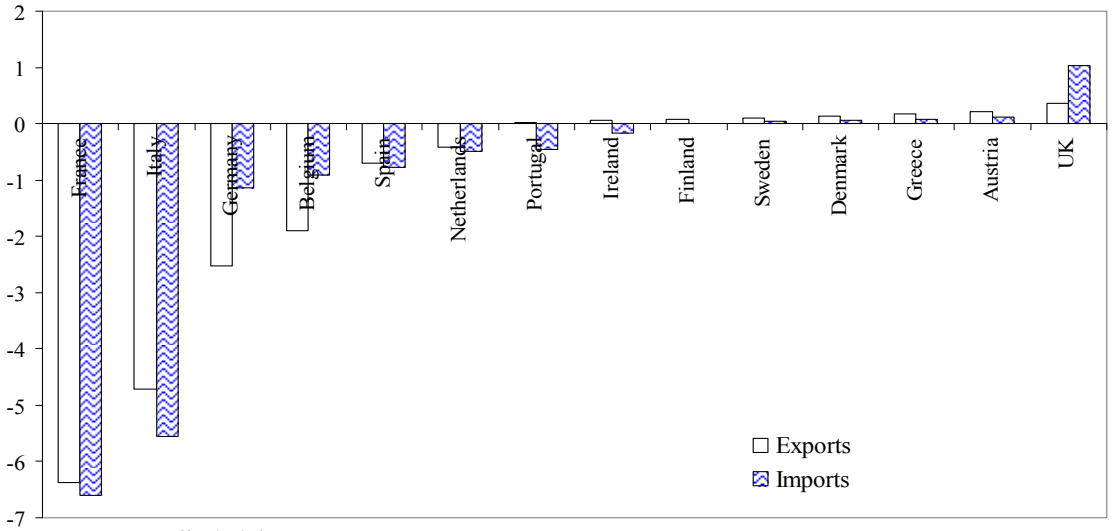
Source: IMF staff calculations

[13] A word of caution: while the methodology used here is by no means uncommon, it deserves to be mentioned that in-sample estimates of trade potentials have been criticized (see Peter Egger (2002), "An Econometric view on the Estimation of Gravity Models and the Calculation of Trade Potentials", *The World Economy*, 25, pp. 297-312).

[14] MENA countries are Algeria, Egypt, Jordan, Libya, Mauritania, Morocco, Syria, and Tunisia. Lebanon and the Palestinian Authority are excluded due to incomplete data.

24. **Tunisia's aggregate trade with the EU widely surpasses model predictions, but an important trade potential remains nonetheless.** A closer look at EU-Tunisian trade reveals that the large wedge between predicted and actual trade levels is explained by significant over trading with a few countries, notably France and Italy. Meanwhile, Tunisia still under trades with half of the EU countries. There is even a substantial trade potential with the UK, estimated at nearly ½ percent of Tunisia's GDP for exports and 1 percent for imports. Indeed, merchandise trade (imports plus exports) between Tunisia and the UK in 2002 was about one third less than, for example, trade with Belgium. This suggests that Tunisia could significantly increase its trade by targeting the UK.

Chart 3. Tunisia's Trade Potential with the EU
(percent of GDP)



Source: IMF staff calculations
Note: Negative trade potentials indicate overtrade.

25. **The wide disparity in Tunisia's trade performance with the EU merits further analysis.** Given that the same trade regime applies EU-wide, any trade-creating impact of EU-Tunisian integration should, in principle, affect Tunisia's trade with all EU countries. Evidently, conventional tariff and nontariff barriers only explain part of Tunisia's trade performance. Migration comes to mind as a potentially important factor that could facilitate the formation of business networks and other ties likely to enhance trade. Migration could not be included in the model due to data limitations but Tunisia's largest "over-traders" in the EU also tend to be the countries with the largest Tunisian immigrant population.[15] Part of

[15] According to the European Migration Centre, France had about 200,000 Tunisian residents in the early 1990s, Italy had 15,000, and Belgium over 6000. Data for other EU countries were not available.

Tunisia's over-trade with France and Italy could possibly also be explained by intra-firm trade, although this can not be confirmed by the aggregate data used for this study. One could speculate that integration with the EU has affected trade primarily with countries with pre-existing ties to Tunisia, although further analysis of the evolution of trade patterns over time would need to confirm this, along with an analysis using more disaggregate data. It would also be useful to examine the role of the textile sector with regards to Tunisia's overtrade with certain EU countries, to get an appreciation of the risks of lost trade associated with the expiration of the Multifiber Agreement (MFA) in 2005.[16]

26. **Trade with non-EU countries broadly match predicted levels, reflecting over-trading with the MENA region roughly compensating for under-trading with the rest of the world.** Total trade with non-EU, non-MENA countries fall somewhat short of predictions driven by weak trade with the US and Japan, more than offsetting over-trading with several other countries.[17] Tunisia's trade potential with the US alone (exports plus imports) is estimated at 2½ percent of GDP. As a comparison, Tunisia's exports to the US in 2002 were only about one third higher than those to Iran and one third lower than those to India. Although a strong candidate, Switzerland is not included among the top trade potentials in the table below because data availability permits calculating only the export potential (¼ percent of GDP).

27. **On the regional front, Algeria is one of Tunisia's largest untapped sources for trade in the world,** substantially surpassed by only the US, the UK, and Japan. This indicates that regional integration efforts are worthwhile, and that from Tunisia's point of view, particular attention to Algeria could prove useful. Tunisia appears already well integrated with other countries in the region—even significantly over-trading with Libya and Morocco.[18] Libya is Tunisia's single largest trade partner outside the EU, with merchandise trade exceeding US$0.5 billion annually. To put Tunisia's trade with Morocco in perspective, it is about double the trade with Portugal.

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[16] The MFA gives Tunisia's and other countries' textile exports preferential access to the EU. The elimination of the MFA will greatly increase competition in textiles, in particular from China. This could potentially have significant consequences for Tunisia's exports, one third of which is textiles.

[17] The main non-EU, non-MENA countries trading with Tunisia beyond predicted levels are Turkey, Russia (imports only), India, Argentina (mainly imports), and Brazil.

[18] It deserves to be mentioned, however, that Tunisia's trade with the two other countries within the Fund's Maghreb Initiative (Algeria and Morocco) represents only 2 percent of total Tunisian trade.

Chart 4. Tunisia's Trade Potential (exports + imports), Top 5 Countries (non EU/MENA, percent of GDP)

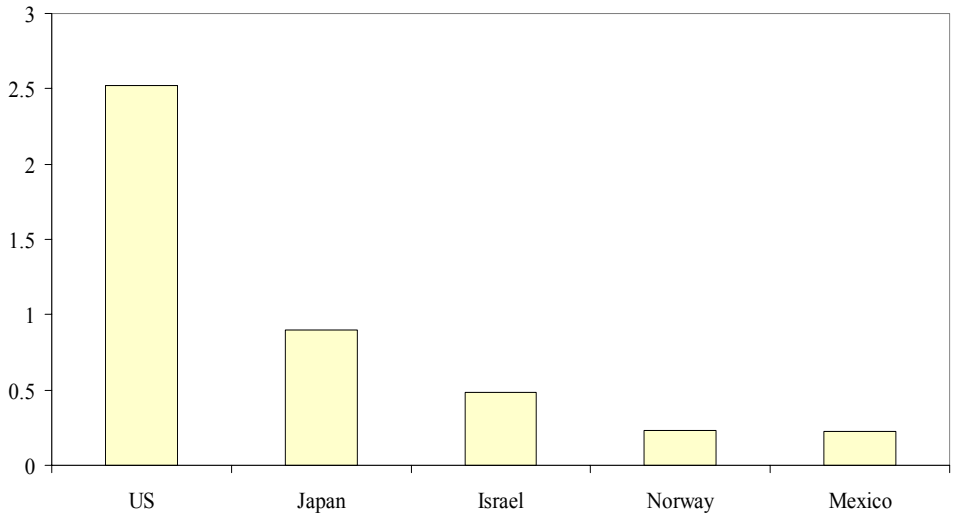
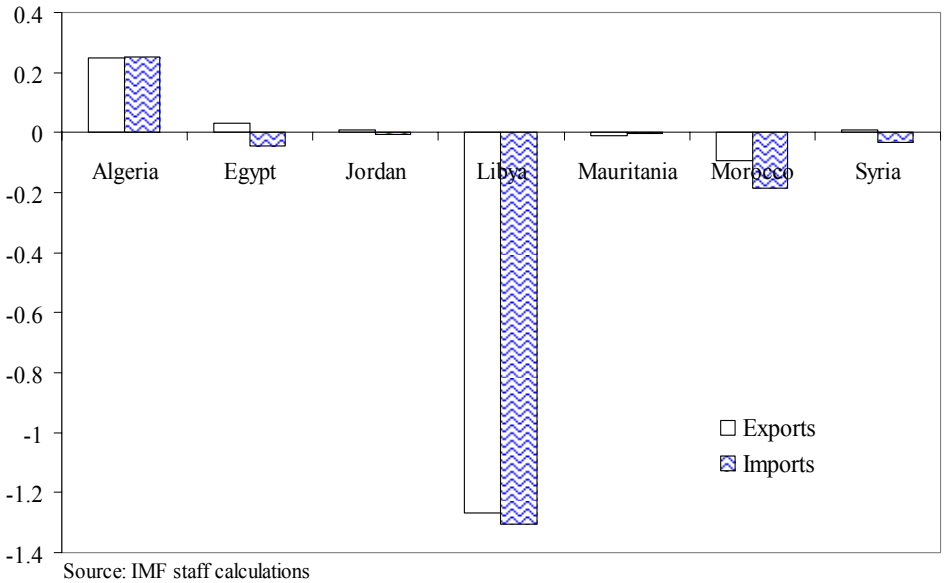


Chart 5.Tunisia's Regional Trade Potential (Percent of GDP)



Source: IMF staff calculations
Note: Negative trade potentials indicate overtrade

C. Conclusions and Policy Implications

28. **There is significant potential to increase Tunisia's trade.** Despite the fact that Tunisia's total trade substantially surpasses model predictions, large unexploited markets remain. Although the scope to increase trade within the EU (in particular the UK) is important, by far the largest potential lies outside the EU (the US and Japan). Tunisia's total trade potential is estimated at 9 percent of GDP, one fourth of which with the EU. This underscores the need for Tunisia to accelerate trade liberalization on a multilateral basis, in parallel with the more advanced integration process with the EU. Within the region, Algeria presents a considerable potential to increase trade. Stepped up efforts to enhance regional integration may therefore also have a measurable impact on Tunisia's total trade.[19]

29. **Continued structural reform to improve competitiveness will be crucial to take advantage of new trade opportunities.** An additional challenge will be to maintain Tunisia's relatively large market share in certain EU countries (in particular France and Italy), especially with the imminent expiration of the MFA. Aside from trade liberalization, it will be important to create a business environment that is flexible and fully market-driven, so that entrepreneurs have the right incentives and the ability to exploit new trade opportunities. With Tunisia's high unemployment and ready access to international capital markets, supply constraints are unlikely to be important hurdles in the medium to long term, assuming enabling structural reforms. One caveat, however, concerns the supply of specialized skilled labor: as Tunisia's trade becomes more diversified, the labor force's skill set will also need to be increasingly diversified. Ensuring that the formal education system matches the need for skills is therefore a priority.

30. **Tunisia's aggregate over trading with the EU should not be interpreted as a sign of serious trade distortions.** Wide differences in the country's trade performance with the EU countries suggest that factors other than conventional trade barriers need to be considered. Moreover, over-trading with a large number of non-EU countries casts some doubts on the idea that EU-Tunisian integration has caused substantial trade diversion, to the point were it would dominate the benefits of any trade creation with the EU. A more thorough analysis including changes in the trade performance over time would be useful before drawing firm conclusions.

[19] Regional integration is also important to mitigate potential "hub-and-spoke" effects arising from the EU's separate trade agreements with Southern and Eastern Mediterranean countries.

Gravity Model Estimations

	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
GDP importing country	1.00 ***	1.00 ***	1.03 ***	1.05 ***	1.26 ***	1.27 ***
GDP exporting country	0.96 ***	0.96 ***	1.04 ***	1.05 ***	1.35 ***	1.34 ***
Population importing country	-0.10 ***	-0.09 ***	-0.13 ***	-0.13 ***	-0.19 ***	-0.18 ***
Population exporting country	0.03 #	0.04 *	-0.01	0.02	-0.11 ***	-0.07 ***
Distance	-1.07 ***	-1.09 ***	-1.07 ***	-1.12 ***	-1.28 ***	-1.34 ***
Common language	0.67 ***	0.60 ***	0.65 ***	0.66 ***	0.93 ***	0.92 ***
Common border	0.75 ***	1.05 ***	0.71 ***	0.92 ***	0.78 ***	1.10 ***
Landlocked 1/	-0.28 ***	-0.23 ***	-0.30 ***	-0.28 ***	-0.23 ***	-0.20 ***
Agricultural share of GDP 2/	-0.19 ***	-0.21 ***	-0.19 ***	-0.22 ***	-0.14 ***	-0.18 ***
Commodity exporter	-0.16 ***	-0.16 ***	-0.02	-0.02	-0.17 ***	-0.16 ***
Colony	0.67 ***	1.17 ***	0.56 ***	0.62 ***	0.46 ***	0.55 ***
North-north trade	-0.16 ***		-0.36 ***		-0.99 ***	
Constant	4.02 ***	4.09 ***	3.85 ***	4.02 ***	3.11 ***	3.40 ***
Number of observations	26,298	24,706	26,298	24,706	26,298	24,706
Estimation method	Tobit Random effects	Tobit Random effects	Tobit pooled	Tobit pooled	OLS	OLS
R-squared	…	…	…	…	0.68	0.65
Sigma_u (pooled v/s RE)	1.19 ***	1.23 ***	…	…	…	…
Number of groups (country pairs)	7,204	6,805	…	…	…	…
Includes time dummies	yes	yes	yes	yes	yes	yes
Includes north-north trade	yes	no	yes	no	yes	no

Source: IMF staff estimates

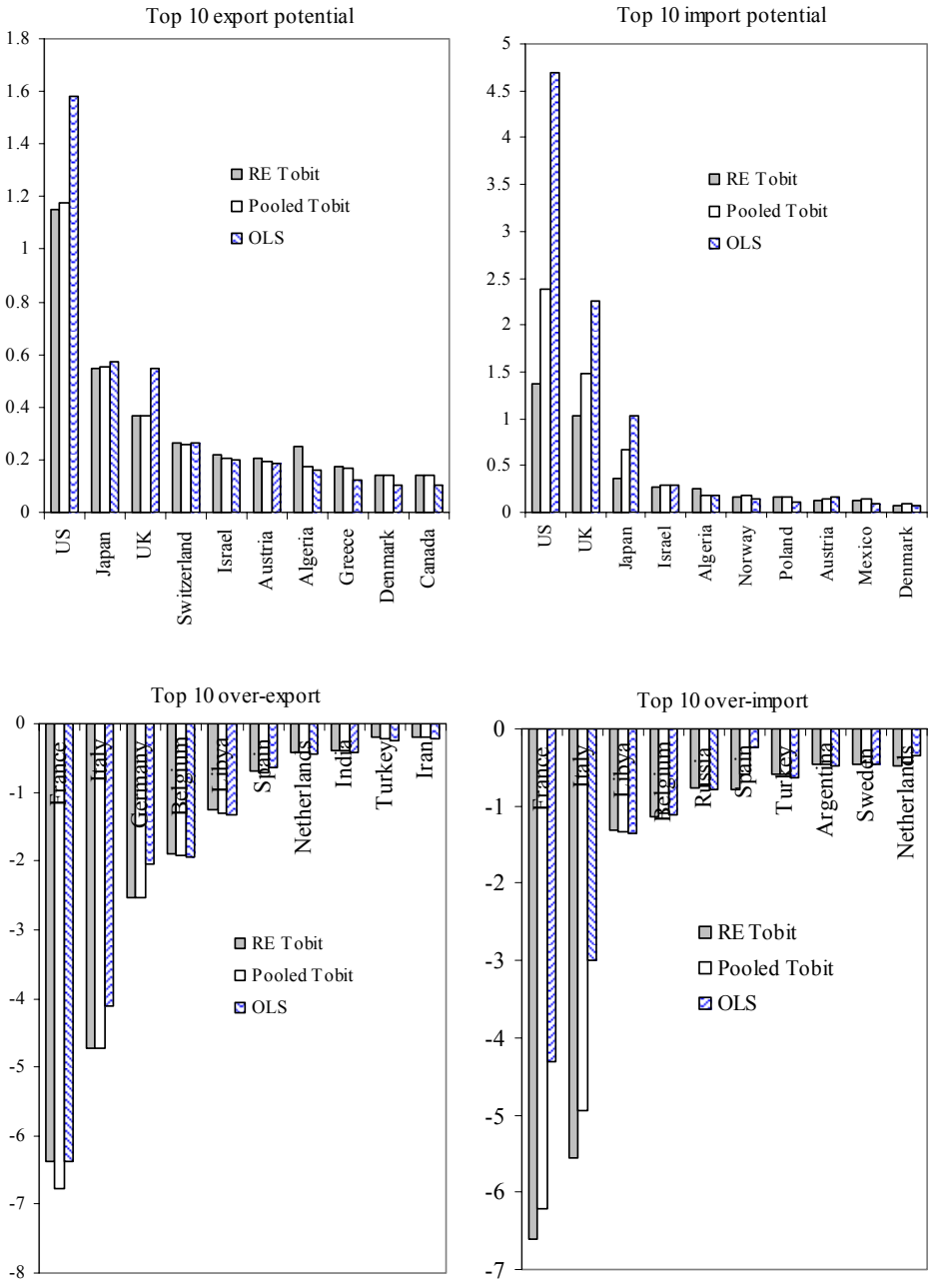
1/ Takes the value one if one of the partner countries is landlocked, two if both are landlocked, and zero otherwise.
2/ Exporting country.
Note: Equations 3-6 are estimated using heteroscedasticity consistent standard errors.
***, **, *, and # indicate statistical significance at the 1, 5, 10, and 15 percent level, respectively.
Wald tests strongly rejected the pooled model in favor of the random effects (RE) model in Equations 1 and 2.
Testing between RE and fixed effects (FE) in the Tobit model was not feasible due the large number of parameters to estimate in the FE model (there are about 7000 country pairs).

Note on econometric issues:

Since the estimated model is expressed in logs, a solution is needed to deal with zero-value observations. Gravity model applications often deal with this issue by omitting zero-value observations. However, this truncates the joint distribution of the data, which introduces an estimation bias. This bias can potentially be sizeable, given that bilateral trade data typically include a large number of zero observations, particularly when developing countries are included. Other solutions include substituting zero observations with an arbitrary small number, or using nonlinear estimation techniques such as the Tobit model used here. The Tobit model explicitly incorporates information in the zero-value observations (for a discussion of the Tobit model in a panel setting, see e.g. B.H Baltagi, Econometric Analysis of Panel Data, John Wiley and sons, Chichester, 2001).

In any case, results turn out to be robust across estimation techniques, as illustrated by the chart below showing the estimated top and bottom 10 estimated trade potentials (divided between imports and exports). Although the magnitude of the estimated coefficients differ across estimation techniques, the net impact of these differences on the estimated trade potentials tends to be small. A significant impact on trade potentials is found only for a few large countries (mainly on the import side). The fact that large countries tend to be affected more than small ones is not surprising, given that the model is expressed in logs while the trade potentials are in absolute levels.

Trade potential (percent of GDP)



Source: IMF staff calculations.

III. How Does Employment Protection Legislation Affect Unemployment in Tunisia? A Search Equilibrium Approach [20]

A. Introduction

31. **Reducing unemployment is at the heart of Tunisia's economic challenges.** In the face of major policy reforms required for Tunisia's economic liberalization and integration into the world economy, employment generation and unemployment reduction are major concerns of the Tunisian government.

32. **The government is well aware that promoting employment and facilitating the reallocation of labor in response to structural changes in the economy require simultaneously sound macroeconomic policies and flexible labor markets.** The literature and other countries' experiences show that high unemployment rates are not only associated with slow economic activity, but can also reflect strict labor market regulations that hamper growth and impede labor market adjustment to shocks. Bentolila and Bertola (1990) and Bertola (1990) argue that high firing costs in Europe and differences in employment protection legislation between countries may explain differences in the dynamics of employment. Similarly, Garibaldi (1998) shows that different dynamics in the US and European labor markets are partly due to the existence of employment protection legislation in Europe. Therefore, tackling unemployment requires action on two fronts: improving economic activity and increasing labor market flexibility. In addition to its direct impact on employment dynamics, a flexible labor market contributes to job creation through its positive effect on growth.

33. **Tunisia's labor regulations are complex and protective, hindering labor market flexibility by not allowing firms to fully adjust employment in response to changing economic circumstances.** Although the authorities have recently introduced temporary employment contracts by increasing flexibility on hiring, job termination regulations remain rigid and protective: dismissals for economic reasons are heavily regulated, and there is strong government interference.[21] So far, the literature has paid little attention to the relation between employment protection regulation and unemployment in Tunisia, focusing instead on the role of economic growth in promoting employment in Tunisia.

34. **Growth has only partially contributed to employment generation in Tunisia.** Despite a relatively strong economic performance and progress in structural reforms, unemployment remains above 14 percent (2003) of the labor force. While average economic growth was about 5 percent per year over the last decade, the unemployment rate was down by only 2 percentage points over the period. Moreover, 1 percentage point of this fall

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[20] The authors of this paper are Taline Koranchelian and Domenico Fanizza.

[21] The law does not require tax payments when firing employees, neither severance payments are high by international standards.

occurred in the last two years after the authorities increased labor market flexibility by introducing temporary employment contracts. Therefore, high growth rates have only partially contributed to generate additional employment in Tunisia.[22] The insufficient flexibility of the labor market appears a good candidate to explain the low elasticity of employment to growth.

35. **Against this background, the purpose of this paper is to examine the role played by employment protection legislation (EPL) in keeping the unemployment rate high in Tunisia**. The paper uses a search equilibrium model with firing restrictions following Garibaldi (1998). We calibrate the model for Tunisia (i.e. defining the rate at which vacant jobs and unemployed workers meet in Tunisia) by estimating a matching function for the period 1974–2003. Simulating the calibrated model provides us with indications on how the existence of firing restrictions affects the outcome of the matching process and the natural rate of unemployment.

36. **The paper concludes that increasing labor market flexibility will not solve Tunisia's unemployment problem per-se, but would have a favorable impact on steady state unemployment**. The simulations show that the removal of firing restrictions could have a limited impact on reducing unemployment. Furthermore, Tunisia's increased integration into the world economy could translate into a higher volatility of the shocks to which the labor market needs to adjust. The simulations with higher variance of shocks that could result from increased opening show that in the absence of firing restrictions the labor market would be more resilient to adverse shocks. Therefore, Tunisia would benefit from considering alternative approaches that rely less on protecting workers within the firm. However, to generate a substantial reduction in the unemployment rate, lower employment protection needs to be accompanied by continued efforts to implement sound economic policies aiming at enhancing Tunisia's growth performance and job creation.

37. **The remainder of this paper is organized as follows:** Section II reviews the literature on the impact of employment protection regulation on unemployment. Section III provides a background on the institutional settings of Tunisia's labor market. Section IV presents the broad features of a search matching model with firing restrictions, which is explained in detail in the appendix. Section V analyzes the impact of firing restrictions on current unemployment in Tunisia by calibrating and simulating the matching model. It also assesses the impact of these restrictions as Tunisia increases its integration into the world economy. Section VI presents the main conclusions.

B. Review of the Literature

38. **Employment protection legislation is a form of employment regulation which relates to employers' freedom to dismiss workers**. According to OECD (1994), employers' freedom to dismiss workers may be restricted in several ways: penalties on unfair dismissals,

[22] The World Bank estimated the elasticity of employment to GDP growth to 0.5 during 1994-2001.

restrictions on lay-offs for economic reasons, compulsory severance payments, minimum notice periods, written justifications, administrative authorizations, etc. The effect of this legislation is similar to a tax on dismissals, even though the firm may not always be required to pay money before it dismisses an employee.

39. **Much attention has been devoted to the analysis of the consequences of EPL in industrial countries.** EPLs inhibit labor market flexibility by reducing the ability of firms to hire or fire workers. The perception that flexible labor markets promote employment and reduce unemployment is widely accepted. Yet, the theoretical and empirical evidence on the net effects of firing restrictions on employment and unemployment are ambiguous. Nevertheless, it has often been suggested that the elevated severance pay and job security requirements in Europe are in part to blame for the high unemployment levels in this continent (Kugler and Pica, 2004).

40. **The theory of job creation and job destruction implies that EPL reduces job destruction, but it also reduces job creation** (Millard and Mortensen, 1997; Millard, 1996; Nickell, 1982). The reason for the reduction in job destruction is obvious enough. EPL is a firing cost (direct or indirect) imposed on the employer, so job destruction, which necessitates firing the employee, becomes more expensive and difficult. Job creation falls for two reasons: (i) since dismissal is costlier (direct cost or lengthier process), the firm creates a job and recruits an employee only if it expects to need the employee for a longer length of time. Equivalently, jobs that are not expected to have a long life are not created when there are strict job destruction rules (Pissarides, 1999); and (ii) with less job destruction, and less flow into unemployment, there are both fewer job seekers and fewer vacancies, which implies that fewer job matches take place.

41. **Theoretical work on the effects of firing costs shows that while reductions (increases) in firing costs are expected to increase (reduce) hiring and firing as well as employment volatility, the net effects of reducing firing costs on employment are ambiguous**. While a recent study (Elmeskov, Martin, and Scarpetta, 1998) suggests a somewhat more robust effect on unemployment if changes in OECD EPL over the past two decades are taken into account, OECD (1999) could not find a statistically significant effect of EPL on aggregate employment. Most of the models in the literature provide the same type of prediction: stricter employment protection has an ambiguous impact on the level of overall employment, because it reduces both job creation and destruction. Nevertheless, empirical regularities were found in other areas, mainly: EPL reduces both job destruction (unemployment inflows) and creation (unemployment outflows). EPL has important effects on the composition of employment, since countries with stricter EPL are associated with higher youth unemployment and larger self employment.

42. **The multiple dimensions of employment protections are difficult to model in a simple way**. The simplest and most widely modeled form of EPL is a fixed firing cost to be incurred by the firm when firing takes place (Bentolila and Bertola (1990) and Bentolila and Saint-Paul (1994) in partial equilibrium models of labor demand, Burda (1992), Millard (1994) and Millard and Mortensen (1994) in search equilibrium models). Another form of job

security provision consists of the existence of firing permissions that cannot be quantified such as fixed firing costs (Garibaldi (1998) in search equilibrium model). The way to capture the effects of procedural constraints in an aggregate model is to assume that a firm can accomplish firing only when it is granted an exogenous firing permission.

43. **This paper uses a search equilibrium approach with firing restrictions, which has the advantage of being dynamic and able to analyze the impact of legal and not cost-related restrictions on labor market dynamics.** By being dynamic, this approach can model both the unemployment stock and its duration. It is also known as the flow approach to the modeling of unemployment, because unemployment flows play a key role in the modeling.[23] The natural rate of unemployment equates the flow into unemployment with the flow out of unemployment. This modeling strategy enables the study of questions related to job search and job turnover, which often provide the key link between policy and unemployment. The model explicitly includes legal restrictions on dismissals, thus it describes well the labor market in Tunisia, where severance payments are relatively low but legal restrictions are high (see below).

C. The Tunisian Labor Market: Institutional Settings

44. **Tunisia has significant labor market regulations, including employment protection.** Government intervention in the labor market has been traditionally substantial. The social dialogue too, operating through a tripartite mechanism, has been important in shaping a wide range of labor market outcomes, including labor reallocation and wage setting. The logic has been to limit the shocks of economic change through strong job security rules.

45. **Hiring rules are flexible but termination regulations are rigid and protective.** Labor regulation reforms in 1994 and 1996 introduced flexibility in hiring through fixed-term contracts and part-time work.[24] However, termination regulations are substantial: dismissals for economic reasons are still heavily regulated, and there is strong government interference. Moreover, reforms to the Labor Code in 1994 and 1996 accelerated the administrative procedures and clarified the definition of "*licenciement abusif*".[25] In the end, however, firms

[23] Pissarides, 1990; Mortensen and Pissarides, 1994.

[24] The main reforms included:

- Introduction of two categories of fixed-term contracts, determinate and indeterminate period of time. Fixed-term contracts are permitted for a maximum of four years, subject to the agreement of the parties.
- Introduction of part-time work. Part time is defined as less than 70 percent of the normal hours. It is based on two principles: freedom of choice for employees and equal treatment with full-time employees.

[25] These reforms stipulated that the complete process, from initial application for downsizing to a final decision of the *Commission du contrôle des licenciements*, should take a maximum of 33 days, unless the parties agree to an extension.

wanting to adjust their workforces for economic or technological reasons still must engage in a heavily bureaucratic process where government and a tripartite mechanism have substantial powers to intervene. Moreover, firms wanting to downsize must first notify the *Inspection du Travail* (IT) in writing, with at least one month advance notice, indicating the reasons and listing the workers to be affected. The *Inspection du Travail* then has 15 days to review the request. If this proposal is not accepted by the employer, then within 3 days the case goes to the central or regional *Commission du contrôle des licenciements* (CCL), which has 15 days to decide on the downsizing application and, where layoffs are involved, on the severance payments owed to the workers.

46. **As a result, temporary jobs have increased and small firms often found solutions outside the legal framework to circumvent those regulations**. In 2001, 13 percent of the labor force had a nonpermanent contract as employers seeking flexibility found it more attractive to offer nonpermanent positions and to avoid the obligations that still exist regarding layoff rights. With an employed labor force of over 2.5 million during 1998–2001, the total number of proposed layoffs represented less than 1 percent of total employment, compared to 10 percent in OECD (OECD 1994).[26] Furthermore, actual retrenchments decreased as temporary unemployment and part-time work became much more important adjustment mechanisms: in 2001, only 14 percent of all proposed layoffs wound up as retrenchments, compared to 30 percent in 1998. Finally, cases going to the CCL (33 percent in 2001 compared to 60 percent in 1998) declined, suggesting that solutions are being found outside the CCL.

47. **Severance payments, although not high in general, can be generous in specific cases.** In the case of retrenchment, minimum severance requirements are established in the Labor Code. *Conventions collectives* can set levels above these established rates. The base formula is one day of pay for each month of service, with a 3-month maximum. This level is not excessive by international standards; however, severance requirements increase a great deal—and are high by international standards—in the case of *licenciements abusifs*. According to the 1994 Labor Code revisions, layoffs are considered *abusif* when (i) there is no just or serious cause, or (ii) the legal procedures, rules, and conventions have not been respected. If the CCL determines that there was no just or serious cause, the severance guideline is 1-2 months of salary per year of service, with a maximum payment of 3 years' salary.[27] While according to international experience, in cases where only the procedures have been violated, the severance payment should be 1–4 months of salary.

48. **Overall, rules to protect job security—mainly Tunisia's retrenchment procedures—create a duality in the labor market**. They increase the stability of existing

[26] This includes job turnover from closures and firm contraction. Data cover the 1980s and early 1990s for 16 OECD countries.

[27] In the case of *licienciement abusif* for fixed-term (CDD) employees, payment should equal the remaining part of the contract.

jobs, though at a price: more long-term unemployment and nonparticipation in the labor force and less opportunity for regular employment in the formal sector.

D. The Model

49. **We use the matching framework developed by Garibaldi (1998).**[28] It is a model *à la* Mortensen and Pissarides (MP) with firing constraints. The features of the model are as follows:

50. The model considers an economy populated by a continuum of risk-neutral workers of fixed quantity. Workers can be in two states, employed or unemployed. Each firm has one job that can be either filled or vacant. A filled job can be either fully operational or idle, depending on whether the firm is actually waiting for firing permissions. Firms with a vacant position search for filling it. Job creation takes place when a firm with a vacant job and a worker meet. Job destruction takes place when a filled job gets a firing permission, separates and leaves the market.

51. The rate at which vacant jobs and unemployed workers meet is determined by the simple matching function $m(v,u)$, where m is a first degree homogeneous matching function and v and u represent the number of vacancies and unemployed workers respectively, normalized by the fixed labor force size. Vacancies are filled at the rate

$$q(\theta)=m(v, u)/v=m(1, u/v);\ \ \theta=v/u \text{ and } q'(\theta) < 0$$

where θ is an index of market tightness from the firm's point of view. The smaller the number of vacancies in relation to the number of unemployed workers, the easier for the firm is to fill vacant jobs. The rate at which workers find jobs is

$$\gamma(\theta) = m(v,u)/u = m(v/u,1) = \theta q(\theta);\ \ \gamma'(\theta) >0$$

thus, the larger the number of vacancies in relation to the number of unemployed workers, the easier for the worker is to find a vacant job.

52. Job creation is defined by the number of matches

$$m(v,u)=vq(\theta).$$

53. Each job is characterized by a fixed irreversible technology and produces a unit of a differentiated product whose productivity is $p + \sigma\epsilon$. The productivity is made up of an aggregate component p, common to every job, and a job specific component ϵ, which differs across jobs.[29] The process that changes the idiosyncratic component of prices ϵ follows Poisson distribution with arrival rate equal to λ. When there is a change in ϵ, the new value of the job specific productivity ϵ is a drawing from the fixed distribution $F(\epsilon)$, which has finite upper support ϵ_u, lower support ϵ_l and no mass point other than at the upper support ϵ_u. This

[28] See appendix for the description of the complete model and the characterization of equilibrium.

[29] σ reflects dispersion and is common to every job. It is a normalizing parameter useful for the simulations.

way of modeling implies a memoryless but persistent idiosyncratic productivity. The persistence of any given productivity ϵ is $1/\lambda$.

54. Filled jobs are said to be fully operative if the idiosyncratic productivity is above some critical value ϵ_d, while they are said to be idle if the job specific productivity is below ϵ_d. Therefore, the rate at which jobs turn idle is $\lambda F(\epsilon_d)$, while workers in idle jobs can be dismissed and leave the market at a rate s. The parameter s summarizes EPL in the model: as $s \to \infty$, EPL are eliminated. Finally, idle jobs are subject to idiosyncratic uncertainty and can return fully operational at rate $\lambda(1-F(\epsilon_d))$.

55. The model departs from the standard Mortensen-Pissarides (1994) framework in the wage-setting behavior. It assumes that employers capture all the rents associated with a job-worker match by paying workers the common alternative value of their time, b.[30] It is well known that in search equilibrium models, wages clear the market since there is no supply and demand to equate. The matching process generates economic rents that need to be shared between the employer and employee according to some exogenous bargaining rule. While often the literature assumes a Nash-symmetric solution for the wage bargaining game, in this model we follow Fanizza (1996) and Garibaldi (1998) assuming that all the rents generated by a match accrue to the employer. This rule can be interpreted as the one which maximizes the flow out of unemployment.

56. The unknowns of the model are the number of job vacancies v and unemployment u, which determine, through the matching technology, job creation, and the critical value for the idiosyncratic component of productivity, ϵ_d, that induces idle job. Steady state unemployment is defined as the level at which the flow in and out unemployment are equal.

57. **The solution of the model in steady state results in the following:**

58. If dismissal of idle workers is unrestricted ($s \to \infty$), the idle rate tends to zero and equilibrium unemployment coincides with equilibrium unemployment in more standard matching models (Mortensen & Pissarides, 1994; Pissarides, 1990). As the average waiting time increases, EPL affect, both job creation and job destruction decisions, and have an ambiguous impact on unemployment.

[30] As Diamond (1971) has shown, this outcome is an equilibrium in a wage setting game played among employers when workers have only the power to accept or reject offers and workers search sequentially at some positive costs. Given this outcome, workers have no incentive to search on the job and their parameters, other than b, do not affect the equilibrium. Alternatively, if we allowed a continuously renegotiated Nash bargain between the firm and the worker, the wage would be higher than the worker reservation utility in operational jobs, where the surplus from the match is positive. But the presence of firing restrictions, would force the firm to pay the worker even when the job is idle and the worker's participation constraint is binding. This would force idle firms to offer the worker his reservation utility b, exactly as in the present model. Thus, a continuously renegotiated bargain would only affect the wage of operational jobs, leaving unchanged the behavior of idle jobs, the distinctive feature of this model. To keep track of such bargains would be analytically tedious and would not change the qualitative results of the paper.

59. On the one hand, stricter EPL has a favorable impact on unemployment since it reduces the flow out of employment by obliging firms to keep workers occupied in idle jobs. On the other hand, stricter EPL reduces the rate at which workers escape unemployment ($\theta q(\theta)$) by directly increasing the number of vacant jobs and indirectly by increasing the expected returns from employing a worker. However, the final result of changes in EPL on the steady state unemployment rate will depend upon the values at the parameters of the model, in particular α and λ.

E. Simulation Results

60. To implement the general stochastic model of the previous sections, we first specify the matching elasticity α by estimating a log-linear Cobb-Douglas matching function $m(v,u)=u^{\alpha} v^{\beta}$ with a time trend for annual data covering the period 1974-2003:

$$\text{Log } m_t = c + \alpha \log u_t + \beta \log v_t + \delta t + \varepsilon_t$$

61. The results of the estimation show that the parameter α is equal to 0.14 in Tunisia (Table 1). Compared to coefficient of the matching function in industrial countries (0.25), the matching process appears to be relatively inefficient in Tunisia.

Table 1. The Matching Function in Tunisia (1974–2003)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.03	0.270	4.75	0.0002
LU	0.14	0.056	2.53	0.0010
LV	0.59	0.009	5.39	0.0000
TIME	0.02	0.005	3.87	0.0011

R-squared	0.95	Sum squared resid	0.07
Adjusted R-squared	0.94	Log likelihood	31.89
S.E. of regression	0.006	Durbin-Watson stat	2.15

62. Calibrating the model for the Tunisian market results in λ=0.05. The real interest rate is set at 0.03. The other parameters values are similar to Mortensen and Pissarides (1994) and to Garibaldi (1996). They are summarized in Table 2.

Table 2. Baseline parameter value

Variables	Notation	Value
Natural turnover	δ	0.02
Price dispersion	σ	0.037
Price distribution	F (.)	uniform
Upper support	ϵu	1
Lower support	ϵ1	-1
Firing restrictions (max)	s	0.2
Firing restrictions (min)	s	1.2

63. The results of the simulation are summarized in Table 3. The average waiting time being 1/*s*, a high *s* is equivalent to low firing restrictions. The results show that easing the current firing restrictions (*s*=0.2) will reduce the equilibrium unemployment by about 1 percentage point and increase job creation (JC) by 15 percent. Furthermore, firing restrictions affect labor market dynamics through their effect on the relative volatility of job creation and job destruction. Thus, the relative variance of job destruction to job creation $\sigma^2_{JD}/\sigma^2_{JC}$ increases dramatically as firing restrictions weaken. Other statistics of Table 4 show that as EPL eases (or as *s* increases from 0.2 to 1.2), both the average duration and the persistence of unemployment fall. EPLs has obviously a strong effect on average idle capacity, which is the average fraction of jobs waiting for dismissed permission.

Table 3. Simulation statistics

α=0.14, λ=0.053

	s=1.2	s=1.0	s=0.8	s=0.6	s=0.4	s=0.2
$\sigma^2_{JD}/\sigma^2_{JC}$	2.518	1.691	1.084	0.559	0.366	0.114
JC	2.016	2.003	1.989	1.945	1.906	1.761
Unemployment	0.135	0.137	0.139	0.137	0.140	0.143
Duration unemployment	8.433	9.019	8.228	9.245	9.682	11.778
Idle capacity	0.015	0.018	0.023	0.029	0.043	0.077
Persistence unemployment	0.902	0.938	0.946	0.959	0.975	0.985

64. Tunisia's increased integration into the world economy is likely to increase the frequency and variance of idiosyncratic shocks to the labor market (i.e. higher values of λ). However, increased integration will push up job creation. The results of the simulation with higher values of λ show that more frequent and stronger shocks will have an adverse effect on average unemployment in Tunisia (Table 4). However, this effect will be more pronounced if Tunisia maintains its current firing restrictions than if it eases them. Thus, when λ increases to 0.056, unemployment could increase up to 17.7 percent if firing restrictions are in place, while it might go up to only 16.9 percent if restrictions are abolished. EPL will raise job

creation (JC) slightly more than under the assumption of a lower λ. Furthermore, as Tunisia further opens to the world economy (higher λ), the duration and persistence of unemployment will also continue to be negatively affected by a stricter EPL.

Table 4. Simulation Statistics, Higher Frequency and Variance of Idiosyncratic Shocks
$\alpha = 0.14$, $\lambda = 0.056$

	s = 1.2	s = 1.0	s = 0.8	s = 0.6	s = 0.4	s = 0.2
$\sigma^2_{JD}/\sigma^2_{JC}$	2.173	1.642	0.894	0.619	0.313	0.118
JC	2.043	2.024	1.993	1.979	1.916	1.771
Unemployment	0.169	0.168	0.172	0.171	0.175	0.177
Duration employment	8.893	8.972	9.403	8.789	10.034	11.245
Idle capacity	0.015	0.018	0.023	0.03	0.043	0.078
Persistence unemployment	0.933	0.937	0.967	0.955	0.98	0.988

F. Conclusion

65. **Increased labor market flexibility in Tunisia will contribute to reducing unemployment**. The removal of firing restrictions is likely to produce a positive but limited impact on unemployment of not more than 1 percent. Furthermore, while Tunisia's increased integration into the world economy could expose the labor market to adverse shocks and increase the rate of unemployment, the latter would increase less in case firing restrictions are removed.

66. **Increased labor market above flexibility will not solve Tunisia's unemployment problem**. Given the limited impact of removing firing restrictions on unemployment, increased flexibility cannot solely address the unemployment problem in Tunisia. This result suggests that the existence of other factors that are preventing unemployment to fall rapidly. One of these factors could be the skill mismatch (i.e. gaps between skills in demand by employers and skills offered by job seekers).

67. The findings of this study suggest that a three-pronged approach to improve employment performance is needed:

- **Continue to implement sound economic policies aiming at achieving high growth rates and promoting private activity**.

- **Consider introducing greater flexibility in the labor market to facilitate the reallocation of labor in response to structural changes in the economy.** As

Tunisia becomes more engaged in opening and restructuring its economy, based on international experience, it would be favorable if employment policy moves away from a model where the government played a central role through large public sector employment, and labor market was tightly regulated. In particular, Tunisia would benefit from considering alternative approaches that rely less on protecting workers through within the firm and more on offering opportunities and protection outside the firm.

- **Review the education and vocational training systems to improve the skill matching**: These systems should be tailored in a way to equip new labor force entrants with the skills in demand by private employers.

DEVELOPMENT OF THE MODEL

The rate at which vacant jobs and unemployed workers meet is determined by the simple matching function $m(v,u)$, where m is a first degree homogeneous matching function and v and u represent the number of vacancies and unemployed workers respectively, normalized by the fixed labor force size.

Vacancies are filled at the rate: $q(\theta)=m(v, u)/v=m(1, u/v)$; $\theta=v/u$ and $q'(\theta) < 0$

If Cobb-Douglas $m(v, u) = v^{1-\alpha} u^{\alpha}$ and $q(\theta) =(v^{1-\alpha} u^{\alpha})/v = (u/v)^{-\alpha} = \theta^{-\alpha}$

The rate at which workers find job is: $\gamma(\theta)= m(v,u)/u= m(v/u,1) = \theta q(\theta)$; $\gamma'(\theta) >0$

Job creation is defined by the number of matches: $m(v,u)=vq(\theta)$.

Each job is characterized by a fixed irreversible technology and produces a unit of a differentiated product whose productivity is $p + \sigma\epsilon$. The productivity is made up of an aggregate component p, common to every job, and a job specific component ϵ.[31] The parameter σ reflects dispersion, and increases in σ representing a symmetric mean preserving spread in the job-specific shock distribution or equivalently an increase in productivity variance.

The process that changes the idiosyncratic component of prices ϵ is Poisson with arrival rate equal to λ. When there is a change in ϵ, the new value of the job specific productivity ϵ is a drawing from the fixed distribution $F(\epsilon)$, which has finite upper support ϵ_u, lower support ϵ_l and no mass point other than at the upper support ϵ_u. This way of modeling implies a memoryless but persistent idiosyncratic productivity. The persistence of any given productivity ϵ is $1/\lambda$.

The model assumes that firms have the option to select the best productivity in the market, and create jobs at the upper support $p + \sigma\epsilon_u$. Once a job is created, however, the firm has no choice over its productivity. Filled jobs are said to be fully operative if the idiosyncratic productivity is above some critical value ϵ_d, while they are said to be idle if the job specific productivity is below ϵ_d. Therefore, the rate at which jobs turn idle is $\lambda F(\epsilon_d)$, while idle jobs get firing permissions and leave the market at rate s. The parameter s summarizes EPL in the model as $s \to \infty$ EPLs are eliminated. Finally, idle jobs are subject to idiosyncratic uncertainty and can return fully operational at rate $\lambda(1-F(\epsilon_d))$.

The model assumes that employers capture all the rents associated with a job-worker match by paying workers the common alternative value of their time, b.

[31] σ is a normalizing parameter useful for the simulations. It is common to every job and has no specific role.

The unknowns of the model are the number of job vacancies v and unemployment u, which determine, through the matching technology, job creation, and the critical value for the idiosyncratic component of productivity, ϵ_d, that induces idle job.

The asset valuation of a filled job, conditional on an idiosyncratic productivity ϵ is:

$$rJ(\epsilon) = p + \sigma\epsilon - b + \lambda \left[\int_{\epsilon_l}^{\epsilon_u} J(x)\, dF(x) - J(\epsilon) \right] + s[max\ \{0, J(\epsilon)\} - J(\epsilon)], \quad (1)$$

where $J(.)$ is the value of a job, r is the exogenous interest rate, $p + \sigma\epsilon - b$ are operational profits at idiosyncratic productivity ϵ. Apart from the flow-term $p + \sigma\epsilon - b$, Eq. (1) involves two capital gain terms. At rate λ the firm loses its current asset value $J(\epsilon)$ and draws a new ϵ from the productivity distribution. At rate s firing permissions arrive and the firm gets an option to destroy the job. Since a destroyed job has zero value, the max operator in Eq. (1) captures the idea that a firm will keep running a job as long as its value is positive. It follows that an operational job is a positively valued job that ignores firing permissions while an idle job is a negatively valued job that is destroyed when permissions arrive. Differentiating Eq. (1) with respect to ϵ, it shows that J(.) is a piece-wise increasing function of ϵ and its derivative reads:

$$J'(\epsilon) = \sigma/(r + \lambda)\ \forall\ J(\epsilon) \geq 0, \quad (2)$$

and,

$$J'(\epsilon) = \sigma/(r + \lambda + s)\ \forall\ J(\epsilon) < 0. \quad (3)$$

If we define the reservation productivity ϵ_d as:

$$J(\epsilon_d) \equiv 0,$$

making use of Eqs. (1) and (3), after an integration by parts, the expected value of a job in Eq. (1) reads:

$$\int_{\epsilon_l}^{\epsilon_u} J(x)\, dF(x) - J(\epsilon)] = \sigma/(r + \lambda) \int_{\epsilon_d}^{\epsilon_u} (1 - F(z))\, dz - \sigma/(r + \lambda + s) \int_{\epsilon_l}^{\epsilon_d} F(z))\, dz \quad (4)$$

The last term of Eq.(4) is the value (negative)of an idle job and is a measure of expected firing costs. As the average waiting time goes to zero ($s \to \infty$), the second term on the right hand side of Eq.(4) vanishes, firing is always possible and it is accomplished as soon as the value of the job is negative. To obtain the cut off value ϵ_d, below which the firm will accept firing permission, we make use of Eq.(4) and we evaluate Eq.(1) at J(.)=0. The reservation productivity solves:

$$p + \sigma\epsilon - b = \sigma/(r + \lambda) \int_{\epsilon_d}^{\epsilon_u} (1 - F(z))\, dz - \sigma/(r + \lambda + s) \int_{\epsilon_l}^{\epsilon_d} F(z))\, dz \quad (5)$$

Eq.(5) is one of the key equations of the model and uniquely determines the reservation productivity as a function of the parameters *r, λ, p, s, b, σ* and the productivity distribution $F(\epsilon)$. The left hand side of Eq.(5) is the profit from the marginal operational job. In an economy with no firing constraints ($s \to \infty$), the second term of the right hand side vanishes, the marginal profit is negative and there is *voluntary labor hoarding* in equilibrium. When firing is instantaneous ($s \to \infty$) but hiring is costly, the firm will hoard labor up to the level in which current losses compensate savings of hiring costs if conditions improve. The presence of firing delays increases, through the last term in Eq. (5), the value of the marginal profits. As the average waiting time for firing permissions increase, a job will be kept running in bad times for a longer period of time because of exogenous constraints and there will be *institutional labor hoarding*. Since the firm anticipates firing restrictions when conditions are bad, in Eq.(5) the firm reduces the extent of voluntary labor hoarding. As *s* falls, it is possible that firing restrictions become so high that the firm will accept firing permissions at a positive profit per period.

Differentiating Eq.(5) with respect to *s* and rearranging, yields:

$$(\partial\epsilon_d/\partial s)\,[s(r+\lambda F(\epsilon_d))+r(r+\lambda)]/(r+\lambda)(r+\lambda+s) = -\lambda/(r+\lambda+s)^2 \int_{\epsilon_l}^{\epsilon_d} F(z))\,dz \qquad (6)$$

Thus $\partial\epsilon_d/\partial s \le 0$: an increase in the average waiting time of permission (fall in *s*) increases the productivity at which the firm takes advantage of firing permissions. This is consistent with the firm anticipating long waiting time when conditions worsen.

The reservation productivity falls with *p*, the common productivity. Differentiating Eq.(5) with respect to (*p-b*) and rearranging, yields:

$$\sigma\,[\partial\epsilon_d/\partial(p\text{-}b)]\,[s(r+\lambda F(\epsilon_d))+r(r+\lambda)]/(r+\lambda)(r+\lambda+s) = -1 \qquad (7)$$

Thus $\partial\epsilon_d/\partial p \le 0$: as the productivity increases the firm will find it profitable to keep a job operational for a higher range of productivities. The effect of other parameters on the reservation productivity is ambiguous. Higher discount rate *r* reduces the flow of income from the job and makes labor hoarding less profitable. This would reduce ϵ_d. But simultaneously, the higher discount rate reduces expected firing costs and makes autonomous labor hoarding profitable. Similar arguments hold for changes in the arrival rate of idiosyncratic shocks. Higher λ corresponds to an increase in the arrival rate of productivity shocks. On the one hand the reservation productivity tends to decrease since the firm expects the duration of adverse conditions to be shorter. At the same time, the probability of facing a firing procedure is higher and the net effect depends mainly on the distribution *F*(.).

68. Job creation comes through the posting of vacancies. When creating a job, we assume the existing technology is fully flexible and the productivity distribution is common knowledge. This implies that new firms have the option to select the best productivity in the market and job creation takes place at the upper support of the distribution (ϵ_u). A posted

vacancy yields an asset return of $-c$ per period, c being the constant cost of hiring, and a probability $q(\theta)$ of being filled with a job created at the upper support of the distribution. The vacancy asset valuation is:

$$rV = -c+q(\theta)[J(\epsilon_u) - V]. \tag{8}$$

With free entry into the job market, there are, in equilibrium, zero expected profits (V=0) (Pissarides, 1990) and the value of a job equals the expected searching costs:

$$J(\epsilon_u) = c/q(\theta), \tag{9}$$

where the value of a job at the upper support of the distribution is obtained subtracting Eq.(5) from Eq.(1) and reads:

$$J(\epsilon_u) = (\epsilon_u - \epsilon_d)/ (r+\lambda), \tag{10}$$

Eq.(9) is the job creation condition and uniquely determines the vacancy unemployment ratio θ as a function of the parameters r, λ, c, the matching function $q(.)$, the upper support of the distribution ϵ_u and the reservation productivity ϵ_d.

$$(\epsilon_u - \epsilon_d)/ (r+\lambda) = c/q(\theta), \tag{11}$$

Differentiating Eq.(11) with respect to common productivity p, yields

$$[\partial\epsilon_d/\partial p] [1/(r+\lambda)] = [q'(\theta)c/q(\theta)^2] [\partial\theta/\partial p], \tag{12}$$

and, making use of the facts that $\partial\epsilon_d/\partial p< 0$ and $q'(.)< 0$, $\partial\theta/\partial p>0$. Higher common productivity, increasing the flow of future profits, increases job creation at given unemployment Conversely, higher job security provisions reduce the expected value of a job and reduce the profitability of new jobs. Job creation at given unemployment falls. Differentiating Eq.(11) with respect to s,

$$[\partial\epsilon_d/\partial s] [1/(r+\lambda)] = [-c\, q'(\theta) /q(\theta)^2] [\partial\theta/\partial s], \tag{13}$$

making use of $\partial\epsilon_d/\partial s< 0$ Eq.(13) implies that $\partial\theta/\partial s>0$.

To close the model, we need to introduce unemployment. With a fixed labor force, a worker can be either unemployed or employed. If employed, a worker can be attached to a fully operational ($\epsilon \geq \epsilon_d$) or to an idle job $\epsilon < \epsilon_d$. Normalizing variables in terms of a constant labor force, the relationship among different labor force status is:

$$u + n_j + n_i = 1, \tag{14}$$

where u is the unemployment rate, n_i is the employed idle capacity, and n_j is the employed operational rate. In an interval dt, the outflow rate (job creation) corresponds to the number of matches per unemployed times the number of unemployed, while the inflow rate (job destruction) corresponds to the fraction of workers in the idle state whose employers obtained firing permission.

$$\Delta u(t) = s\, n_i(t) - \theta\, q(\theta)\, u(t), \tag{15}$$

where $\theta\, q(\theta)$ is the job finding rate. Eq. (15) defines unemployment variation as the difference between job destruction and job creation. Simultaneously, there are a number of fully operational jobs that are hit by a shock below the reservation productivity and enter the idle state. The outflow from the idle state corresponds to the idle jobs that have obtained firing permissions plus those idle jobs that, hit by a positive productivity shock, return to be fully operational. The inflow into the idle state is given by the operational jobs hit by a shock below the reservation productivity. The change in the idle rate is:

$$\Delta n_i(t) = \lambda\, F(\epsilon_d)\, n_j(t) - [s - \lambda\, (1-F(\epsilon_d))]\, n_i(t). \tag{16}$$

In steady state equilibrium, the unemployment rate and the employment composition between idle and operational jobs is constant. From Eqs. (15) and (16) it follows that unemployment and the idle rate are constant if the inflow rate is equal to the outflow rate. Steady state idle rate is:

$$n_i^* = [\theta\, q(\theta)\, u^*] / s\,, \tag{17}$$

and steady state equilibrium unemployment is:

$$u^* = \lambda\, F(\epsilon_d) / [\lambda\, F(\epsilon_d) + \theta\, q(\theta)\, (s + \lambda)/s]. \tag{18}$$

In steady state, the system is recursive and it reduces down to four equations. Eq.(5) uniquely determines the reservation productivity ϵ_d, while Eq.(11), given ϵ_d, uniquely determines the vacancy/unemployment ratio θ. Given θ and ϵ_d, Eq.(17) and (18) simultaneously determine unemployment and the idle rate. Finally, given the unemployment rate, θ determines vacancies.

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